1971

A producer oriented model for programming crop production

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by

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A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
MASTER OF SCIENCE

Major Subject: Agricultural Economics

Signatures have been redacted for privacy

Iowa State University
Of Science and Technology
Ames, Iowa

1971

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INTRODUCTION

The role of corn and soybean production has increased in importance to many farmers with the advancement of specialized agriculture. These cash grain farmers have foregone livestock and other crop production to increase the scale of their corn and soybean production. Other farmers, although not specialized in corn and soybean production, indicate recognition of the importance of the corn, soybean, oats and/or meadow production in their farm organizations by planning livestock enterprises around the critical time periods for crop production.

Tables 1 and 2 on the following pages indicate the magnitude of corn and soybean production for twelve Corn Belt states. Table 3 presents the aggregate corn production for the two regions for the years 1962 to 1968 and gives the number of acres devoted to corn production during those years. Using the preliminary 1970 estimates, the seven leading states in corn production (Iowa, Illinois, Minnesota, Indianna, Nebraska, Ohio and Missouri) produced 77% of the nation's corn grain (3.15 of the 4.10 billion bushels) (16). Of these seven states, six also ranked among the top seven states in soybean production, Nebraska being the exception. The six states produced 72% of the nation's soybeans (.737 of the 1.13 billion bushels) (16).

Table 4 gives the oats production of the twelve states which makeup the East North Central and the West North Central producing regions. Of the twelve states presented, the eight top states in oats production are represented, and Missouri, the lowest producing state represented, ranks sixteenth in the United States.

Table 5 indicates the magnitude of hay production (both tame and wild hay) for the two regions discussed. These regions represent approximately 50% of the total U.S. hay produced.

Table 1. Corn grain production by states in the corn belt, 1968 through 1970[a]

	Yield per acre 1968	Yield per acre 1969	Yield per acre Preliminary 1970	Production 1968	Production 1969	Production Preliminary 1970
	bushels			1,000 bushels		
(East North Central Region)						
Ohio	84.0	85.0	77.0	242,256	232,900	225,764
Ind.	85.0	96.0	75.0	407,150	446,016	372,825
Ill.	89.0	98.0	75.0	897,832	956,774	768,825
Mich.	76.0	74.0	80.0	96,216	93,684	111,440
Wis.	93.0	83.0	83.0	163,122	139,772	145,333
(West North Central Region)						
Minn.	81.0	85.0	86.0	368,388	355,640	381,410
Iowa	93.0	98.0	87.0	912,144	922,768	876,525
Mo.	83.0	70.0	61.0	245,514	182,210	173,057
N. Dak.	49.0	55.0	49.0	6,468	6,765	5,341
S. Dak.	46.0	57.0	34.0	110,354	139,479	91,528
Nebr.	74.0	93.0	68.0	313,686	433,659	348,772
Kans.	75.0	74.0	57.0	85,050	91,464	76,779

[a]Source: U.S.D.A. Statistical Reporting Service (16).

Table 2. Soybean production by states in the corn belt, 1968 through 1970[a]

	Yield per acre			Production		
			Preliminary			Preliminary
	1968	1969	1970	1968	1969	1970
	bushels			1,000 bushels		
(East North Central Region)						
Ohio	30.5	29.0	29.5	69,418	67,976	71,921
Ind.	32.0	32.0	32.0	103,872	104,896	103,840
Ill.	31.5	33.5	31.0	209,884	220,966	206,522
Mich.	26.0	23.0	26.0	12,038	11,822	13,910
Wis.	22.0	19.0	20.0	3,542	3,306	3,480
(West North Central Region)						
Minn.	22.0	24.0	26.5	71,104	76,008	82,256
Iowa	32.0	33.0	33.0	177,952	174,339	181,302
Mo.	28.0	26.0	26.0	102,564	81,900	90,896
N. Dak.	15.5	16.5	15.0	3,332	3,052	2,715
S. Dak.	17.5	24.5	16.0	5,250	6,321	4,080
Nebr.	23.5	33.0	23.0	18,377	26,829	19,826
Kans.	25.0	23.0	15.0	23,925	19,596	13,170

[a]Source: U.S.D.A. Statistical Reporting Service (16).

Table 3. Corn grain production by region for the years 1962 through 1968[a]

Year	East North Central Region Acreage harvested 1,000 a.	Yield per acre bu./a.	Production 1,000 bu.	West North Central Region Acreage harvested 1,000 a.	Yield per acre bu./a.	Production 1,000 bu.
1962	18,051	80.0	1,443,982	26,103	63.7	1,662,414
1963	19,116	82.5	1,576,525	28,687	66.4	1,906,148
1964	19,803	73.6	1,458,242	24,725	60.9	1,505,331
1965	20,619	87.3	1,799,325	24,326	69.8	1,698,169
1966	21,611	79.6	1,721,245	25,331	76.4	1,934,655
1967	22,520	88.7	1,997,299	27,175	75.4	2,049,053
1968	20,932	86.9	1,819,494	24,917	80.8	2,012,360

[a]Source: U.S. Department of Agricultural Economic Research Service (17).

Table 4. Oat production by states in the corn belt, 1968 through 1970[a]

	Yield per acre			Production		
			Indicated			Indicated
	1968	1969	1970	1968	1969	1970
	bushels			1,000 bushels		
(East North Central Region)						
Ohio	66.0	58.0	57.0	45,078	32,480	29,355
Ind.	63.0	59.0	55.0	22,617	19,706	16,555
Ill.	66.0	61.0	57.0	49,896	43,798	36,822
Mich.	59.0	57.0	59.0	32,981	26,106	28,379
Wis.	61.0	61.0	60.0	106,079	102,907	101,220
(West North Central Region)						
Minn.	60.0	56.0	51.0	197,340	193,368	174,318
Iowa	59.0	50.0	57.0	106,436	92,000	98,610
Mo.	45.0	37.0	41.0	10,935	6,290	8,692
N. Dak.	49.0	56.0	38.0	103,390	139,440	105,982
S. Dak.	45.0	46.5	41.0	106,065	109,600	105,329
Nebr.	27.5	43.5	40.0	12,760	23,838	22,360
Kans.	38.0	38.0	40.0	6,840	6,080	9,600

[a]Source: U.S.D.A. Statistical Reporting Service (15).

Table 5. Total hay production by regions for the years 1962 through 1968[a]

Year	East North Central 1,000 tons	West North Central 1,000 tons
1962	23,732	44,929
1963	22,060	39,700
1964	22,613	39,104
1965	22,437	43,471
1966	22,791	40,531
1967	22,237	41,347
1968[b]	23,325	40,565

[a]Source: U.S. Department of Agricultural Economic Research Service (17).

[b]Preliminary estimates.

Because of the great importance of corn and soybean production to the individual farmer and to the Corn Belt, the questions which follow are deserving of study. What is the optimal level of corn and soybean production given a specific acreage and other cropping alternatives? Should a farm operator rent more land; should he hire supplemental labor? If land renting is considered, then what is the optimal level of production of each crop? What is the optimal farm size given a specific machinery set?

In the study conducted by Frisby (4) a computer program was developed for use in determination of optimal farm size for a given machinery combination. The program increased the corn acreage by one hundred acre units until the product of the probability that the last unit could be harvested successfully and the returns from that unit was equal to the cost of producing the marginal unit. The field suitable days concept was introduced to restrain the number of acres of corn harvested in any fall period. Net returns were over-estimated because field losses in the form of dropped ears was not given consideration.

In the study by the Department of Agricultural Economics (3) at the University of Illinois, field losses were given consideration in selection of a corn harvest system. A budgeting approach for determination of a machinery set was illustrated. However, by reversing the process one could also ascertain the level of corn acreage where the cost of production of the marginal acre (including the field losses as a budgeted cost) equalled but did not exceed returns from production.

A Purdue University extension and research group (2) improved the application of the materials presented in prior studies. The development of a computer linear programming model has helped answer the question on optimal farm size when timeliness (field losses), land renting and labor hiring were given consideration in the number of acres of corn planted. The application of linear programming then provided an easy method of taking into consideration several factors to determine the number of acres of corn production such that the return from the last unit of production equalled its cost. Yet important parameters were missing. How many acres of soybeans, oats and meadow should be produced when their production competes for the same resources and the same machines and their operators during suitable field time?

With the feed grain program of the 1960's exerting such a strong influence on the choice between corn, soybean, oats, or hay production, the 1970 set-aside program is also a consideration in the decision process. Feed grain program payments and participation influences are presented in Tables 6 and 7 to validate the importance of feed grain participation. For the year 1968, 1.166 billion dollars, an average of 11.8 cents on every bushel of total national production, was paid to participating farmers which represented 61.1% of the total national

Table 6. Corn price support payments, season average prices and average prices including payments, 1966-68[a]

	1966	1967	1968[f]
Price support payments			
Total[b] (mil. bu.)	449.0	428.5	514.4
Rate per bushel[c] (dol./bu.)	.30	.30	.30
United States			
Total production (mil. bu.)	4,117	4,760	4,375
Season average price (dol./bu.)	1.24	1.03	1.06
Average payment per bushel produced (dol./bu.)	.109	.090	.118
Season average price including payment (dol./bu.)	1.35	1.12	1.18
Participants in feed grain program			
Estimated production[d] (mil. bu.)	1,775	2,175	2,143
Average payment per bushel produced (dol./bu.)	.25	.20	.24
Season average price including payment[e] (dol./bu.)	1.49	1.23	1.30

[a]Source: U.S. Department of Agricultural Economic Research Service (17).

[b]Total price support payments earned by farmers participating in the Feed Grain Program.

[c]Payment made on the computed "normal" production on the participant's permitted acreage in 1963-65 and the projected production on 50 percent of his base acreage in 1966-68.

[d]Production computed on the basis of acreage planted on participant's farms and U.S. average yield. Includes grain equivalent of silage and forage.

[e]U.S. season average price, plus average price support payments to participants.

[f]Preliminary.

Table 7. Summary of results of the 1966, 1967 and 1968 feed grain programs, United States[a]

Item	Unit	1966	1967	1968[b]
National base acreage[c]	mil. a.	90.4	90.4	90.4
Base acreage on participating farms	mil. a.	51.1	49.5	55.2
Percentage of U.S. base	pct.	56.5	54.8	61.1
Acreage diverted				
U.S. total[d]	mil. a.	23.7	16.2	25.4
Percentage of:				
U.S. base acreage	pct.	26.2	17.9	28.1
Base acreage on participating farms	pct.	46.4	32.7	46.0
Acreage planted				
U.S. total	mil. a.	66.3	71.1	64.8
Acreage on participating farms	mil. a.	24.6	28.0	27.3
Percent of total	pct.	37.1	39.4	42.1
Payments earned				
Diversion payments	mil. dol.	579	302	652
Price support payments	mil. dol.	449	428	514
Total	mil. dol.	1,028	730	1,166

[a]Source: U.S. Department of Agricultural Economic Research Service (17).

[b]Preliminary.

[c]Base on 1959 and 1960 averages, including acreage in the Conservation Reserve Program and proven acreage.

[d]Total diversion not compiled by states; national totals computed on basis of acreages diverted for payment plus estimated acreage diverted at the 20 percent level without payment.

corn base acreage. This total of $1,166 million paid out was comprised of two types of payments, $652 million for diversion payment and $514 million for price support indicating the farmers' economic evaluation of profitability of participation above the 20% level (17). Although no provisions for participation above the 20% level have been made in the 1971 program, the question of how the 1970 set-aside program influences the optimal pattern of corn, soybean, oat, and meadow production is an important one.

Each farmer has to consider the complete range of factors which influence his decision in the economically optimal combination corn, soybean, oats, and meadow production and set-aside program participation. The factors which influence this decision are yield and price expectations, costs of renting land and hiring labor, the prices of fertilizer, insecticides, herbicides and other inputs, timeliness, weather and soil related suitable field days, the number of hours of work available on each day suitable for field work, and the equipment set under consideration.

The task of taking into account all the factors simultaneously is nearly impossible using standard budgeting methods. Linear programming, which can provide a reasonably accurate decision basis has been available for several years but has been severely restricted in its use by farmers because of the time and skill involved in developing the model and processing and interpreting the results. Model construction and interpretation of the results have been restricted to trained professionals. Because these people are few in number and specialized in their training, the cost involved to employ such people to do the programming was considered economically prohibitive. In recent years efforts have been directed at development of programs which can substitute computer time for that of the professional. Purdue University's corn production model was a pioneering step in this attempt (2) (14) (18).

The specific objective of this study is the development of a model and a systemized program which can be utilized in making an economic evaluation on the points which follow, when the factors (yields, prices of inputs, commodity prices, suitable field days, timeliness, labor resource availability, land supply, machine technical coefficients) are given simultaneous consideration:

1. The optimal combination of corn, soybean, oats, and meadow production, and set-aside program participation when a given acreage and machinery set is considered.
2. The optimal farm size and the combination of crop production in the optimal farm plan.
3. The level of set-aside program participation in the optimally sized farm.
4. The profitability of land renting and labor hiring under various circumstances.

FACTORS, CONDITIONS AND CHARACTERISTICS TO CONSIDER IN SELECTING A METHOD OF EVALUATION

The forepart of this section develops the conditions considered essential for profit maximization. Classical theory is assumed as a starting point in this development. Reasons are given why classical theory cannot be directly applied to the real world. Hence necessary modifications are presented which result in a restrictive classical objective function, yielding results equivalent to those derived by linear programming. This equivalence is then used as justification for the acceptability of linear programming methods applied in this study.

The latter part of this section illustrates the optimization process of a standard linear programming problem. The purpose of this illustration is to demonstrate the process which underlies the revision procedure introduced later. The latter procedure is critical to the economical optimization of the farm planning model presented later.

Acceptability of the Linear Programming Solution

Given the objective of maximization of returns to labor, management, and investment in capital inputs, consideration of the profitability of one or more individual enterprises is not an adequate evaluation. The farm manager must make an evaluation that results in a solution closely paralleling the conditions derivable from the classical profit function for maximization of profit.

Derivation of the conditions which maximize income with a classical objective (profit) function can be illustrated using an objective function for constant returns to scale (see Heady (6) for acceptable use of the Cobb-Douglas production function in relation to constant returns to scale on a farm level). One could have the following profit function for the production of two commodities:

$$\pi = p_1 a_1 x_{11}^{b_{11}} x_{12}^{b_{12}} + p_2 a_2 x_{21}^{b_{21}} x_{22}^{b_{22}} - p_{x1} x_{11} - p_{x2} x_{12} - p_{x1} x_{21} - p_{x2} x_{22}$$

where x_{ij} is the input j used in the production of commodity i. P_i is the price of commodity i. P_{xj} is the price of input j, and b_{11} plus b_{12} equals 1 and b_{21} plus b_{22} equals 1. Taking the partial derivatives with respect to each input and setting to zero yields:

$$\frac{\partial \pi}{\partial x_{11}} = b_{11} p_1 a_1 x_{11}^{b_{11}-1} x_{12}^{b_{12}} - p_{x1} = 0$$

$$\frac{\partial \pi}{\partial x_{12}} = b_{12} p_1 a_1 x_{11}^{b_{11}} x_{12}^{b_{12}-1} - p_{x2} = 0$$

$$\frac{\partial \pi}{\partial x_{21}} = b_{21} p_2 a_2 x_{21}^{b_{21}-1} x_{22}^{b_{22}} - p_{x1} = 0$$

$$\frac{\partial \pi}{\partial x_{22}} = b_{22} p_2 a_2 x_{21}^{b_{21}} x_{22}^{b_{22}-1} - p_{x2} = 0$$

Thus the inputs should be employed until the value of the marginal product is equal to the price of that input which could be characterized by the condition

1. $VMP_j = p_{xj}$

x_{11} is the same input as x_{21} and x_{12} is the same input as x_{22}. Thus, one can also form the following equations because the inputs (x_{11} and x_{21}) and the inputs (x_{12} and x_{22}) have the same prices p_{x1} and p_{x2} respectively.

$$p_1 b_{11} a_1 x_{11}^{b_{11}-1} x_{12}^{b_{12}} = p_2 b_{21} a_2 x_{21}^{b_{21}-1} x_{22}^{b_{22}}$$

$$p_1 b_{12} a_1 x_{11}^{b_{11}} x_{12}^{b_{12}-1} = p_2 b_{22} a_2 x_{21}^{b_{21}} x_{22}^{b_{22}-1}$$

which can then be summarized to

2. $\frac{p_1}{p_2} = \frac{MPP_{11}}{MPP_{21}}$ and $\frac{p_1}{p_2} = \frac{MPP_{12}}{MPP_{22}}$

where MPP_{ij} represents the marginal physical productivity of input j in production of commodity i. This condition states that inputs should be employed in the production of all commodities until the ratios of the marginal physical productivities equal the price ratio of the commodities. The following equation can also be derived from the conditions specified in 2:

$$\frac{MPP_{11}}{MPP_{21}} = \frac{MPP_{12}}{MPP_{22}}$$

because both marginal productivity ratios are equal to the same commodities' price ratio. Then an equivalent equation,

3. $\frac{MPP_{11}}{MPP_{12}} = \frac{MPP_{21}}{MPP_{22}}$

states that the marginal rate of technical substitution of input 1 for 2 must be equal in production of both commodities.

Hence these three conditions serve as criteria for the acceptability of the decision making scheme employed.

As viewed in the classical profit function, classical theory assumes continuous input functions but continuous input functions do not exist for all inputs in real world agriculture. Examples of discontinuity are plowing, disking, and spreading fertilizer. These operations on an acre basis are performed in integer quantities i.e., they are not performed or are performed at a level of 1,2---n units. Agricultural inputs also often must be combined in fixed ratios, a phenomena contrary to the classical theory. Thus, no substitution exists between some inputs in the production of a single commodity and thus the MPP of any single input is zero.

Utilizing the classical objective function and adding the necessary restraints to correct for the discontinuity of the input functions and the fixity of input combination the restricted objective function may be defined for the real world:

$$\pi' = p_1 a_1 x_{11}^{b_{11}} x_{12}^{b_{12}} + p_2 a_2 x_{21}^{b_{21}} x_{22}^{b_{22}} - p_{x1} x_1 - p_{x2} x_2$$

where b_{11} plus b_{12} equals 1 and b_{21} plus b_{22} equals 1 such that for each x_{11} used $d_1 x_{12}$ units also must be used, for each x_{21} used $d_2 x_{22}$ units must be used, and x_{11}, x_{12}, x_{21} and x_{22} must be integers. Additionally,

$$x_1 = x_{11} + x_{12}$$

$$x_2 = x_{21} + x_{22}$$

It is also assumed inputs x_1 and x_2 are variable and can be purchased at market prices p_{x1} and p_{x2}. Intuitively one can verify the equality of the results derived by solving the restrained objective function and the linear programming formulation of the problem.

The Optimization Process and Technique

The material presented henceforth in this chapter is illustrative of the theory used in derivation of solutions to problems in the systemized computer approach. The simplex algorithm procedure used along with numerical examples are discussed in detail in Linear Programming Application to Farm Planning by Beneke and Winterboer (1) or a more complete treatment can be found in Linear Programming Methods by Heady and Candler (7).

Arranging the modified classical model in a linear programming framework with disposal activities results in:

Row Name	RHS	y_1	y_2	y_{x1}	y_{x2}	d_1	d_2	d_3
R1	x_1	d_{11}	d_{21}	-1	0	1	0	0
R2	x_2	d_{12}	d_{22}	0	-1	0	1	0
R3	x_3	1	1	0	0	0	0	1
OBJ		p_1z_1	p_2z_2	$-p_{x1}$	$-p_{x2}$	0	0	0

where z_1 is equal to $a_1x_{11}^{b_{11}}x_{12}^{b_{12}}$ and z_2 is equal to $a_2x_{21}^{b_{21}}x_{22}^{b_{22}}$.

Partitioning the above array yields:

$$P_0 = \begin{pmatrix} d_{11} & d_{21} & -1 & 0 \\ d_{12} & d_{22} & 0 & -1 \\ 1 & 1 & 0 & 0 \end{pmatrix} \qquad P_s = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$X_0 = \begin{pmatrix} y_1 \\ y_2 \\ y_{x1} \\ y_{x2} \end{pmatrix} \qquad X_s = \begin{pmatrix} d_1 \\ d_2 \\ d_3 \end{pmatrix} \quad S = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}$$

$$C_0 = \begin{pmatrix} p_1 z_1 \\ p_2 z_2 \\ -p_{x1} \\ -p_{x2} \end{pmatrix} \qquad C_s = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

P_0 is the array of the non-basis vectors.

X_0 is the array of the non-basis variables.

P_s is the array of the basis vectors.

X_s is the array of the basis variables.

S is the RHS or supply array.

C_s is the array of the objective function elements corresponding to the variables in the basis.

C_0 is the array of the objective function elements corresponding to the variables not in the basis.

These partitioned arrays can then be manipulated according to the steps below to determine an optimal solution.

1. The first step is to calculate the R array where $R=P_s^{-1}P_0$.
2. Calculation of the D array yields the returns less opportunity costs for the non-basis variables, where $D=C_0' - C_s'R$. Selecting the most positive element in the D matrix determines which vector and variable will be substituted into the P_s and the X_s matrices respectively.
3. Finding the most limiting resource by selecting the smallest positive element of s_i/r_{in} determines which vector and variable in the P_s and X_s matrices respectively will be substituted for in step 2. The ratios represented by s_i/r_{in} are formed by dividing each row element in the supply matrix by the corresponding row elements of column n where n represents the column which contained the largest positive element in the matrix D.
4. The elements in the C_0 and C_s matrices are also substituted to correspond to the variable substitution occurring in the X_s and X_0 matrices.
5. A new supply matrix is then calculated using the formula $S_{new}=S_{old} - (r_{in})$ (smallest s_i/r_{in} ratio) and substituting the smallest ratio element for the zero element in S_{new}.
6. Steps 1 and 2 are repeated to determine if all the elements of the D matrix are negative or zero.

Should all the elements be negative or zero the optimal solution has been determined and the processing is stopped. However, if all the elements are not negative or zero then steps three through five are performed and steps one through two are repeated to permit another test. This series of steps is continued until all elements in the D matrix are negative or zero.

To illustrate the procedure presented in the six steps, derive the D matrix, where

$$D=C_0' - C_s'(P_s^{-1}P_0)$$

or

$$D=(p_1z_1 \; p_2z_2 \; -p_{x1} \; -p_{x2}) - (0 \; 0 \; 0) \begin{pmatrix} r_{11} & r_{12} & r_{13} & r_{14} \\ r_{21} & r_{22} & r_{23} & r_{24} \\ r_{31} & r_{32} & r_{33} & r_{34} \end{pmatrix}$$

$$=(p_1z_1 \; p_2z_2 \; -p_{x1} \; -p_{x2}) - (0 \; 0 \; 0 \; 0)$$

$$=(p_1z_1 \; p_2z_2 \; -p_{x1} \; -p_{x2})$$

Now select the most positive element in D. Let p_1z_1 be the most positive; thus it has been determined that the first column vector in the P_0 matrix and the y_1 variable in the x_1 matrix will be substituted into the P_s and X_s matrices respectively. Now divide the elements of S (s_i) by the corresponding elements of the first column vector of matrix R (r_i). The first column in the R matrix is used because it corresponded to the largest positive element in the D matrix. Selecting the smallest positive element of the resulting vector defines which column vector in the P_s and which variable x_i in the X_s matrix will be substituted for. Let s_1/r_{11} represent the smallest ratio thus derived. Now we know that vector 1 of the P_0 matrix is substituted for vector 1 of the P_s matrix and vice versa. Also the y_1 variable is substituted for d_1 in the X_0 and X_s matrices respectively. The reverse substitution is also performed. Also the C_0 and C_s elements are substituted to correspond to the variable in the X_0 and X_s matrices. Then we need only derive the new S matrix which is found by

$$S=\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} \quad -z_i \begin{pmatrix} r_{11} \\ r_{21} \\ r_{31} \end{pmatrix} \quad = \begin{pmatrix} 0 \\ x_2-(x_1/r_{11})\ (r_{21}) \\ x_3-(x_1/r_{11})\ (r_{31}) \end{pmatrix}$$

where z_i is the smallest positive ratio derived (x_1/r_{11}). the ratio x_1/r_{11} however is substituted for the zero in the first element position of matrix S.

Thus far we have completed the steps one to five, and the resulting partitioned matrices are:

$$P_0=\begin{pmatrix} 1 & d_{21} & -1 & 0 \\ 0 & d_{22} & 0 & -1 \\ 0 & 1 & 0 & 0 \end{pmatrix} \qquad P_s=\begin{pmatrix} d_{11} & 0 & 0 \\ d_{12} & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$$

$$X_0=\begin{pmatrix} d_1 \\ y_2 \\ y_{x1} \\ y_{x2} \end{pmatrix} \qquad X_s=\begin{pmatrix} y_1 \\ d_2 \\ d_3 \end{pmatrix} \qquad S=\begin{pmatrix} x_1/r_{11} \\ x_2-(x_1/r_{11})\ (r_{21}) \\ x_3-(x_1/r_{11})\ (r_{31}) \end{pmatrix}$$

$$C_0 = \begin{pmatrix} 0 \\ p_2 z_2 \\ -p_{x1} \\ -p_{x2} \end{pmatrix} \qquad\qquad C_s = \begin{pmatrix} p_1 z_1 \\ 0 \\ 0 \end{pmatrix}$$

Steps one through five having been performed and the necessary substitutions executed, we now return to steps one and two to test if an optimal solution has been derived. If an optimal solution has been derived, processing is ended except to derive the value of the program. However, if an optimal solution has not been achieved steps three through five are executed and the necessary substitutions are performed. The steps one and two are then reperformed to make another test.

Because the number of iterations (cycles through steps one to five) becomes very large for the size of the model needed to give consideration to the several factors involved in this study; the SAVE, REVISE and RESTORE procedure is employed 1. to change the resource levels and technological coefficients of a previously optimized model, 2. to make the necessary adjustments in the basic and non-basic matrices, and 3. to start the re-optimization process several iterations removed from the original tableau. The SAVE, REVISE and RESTORE procedure utilizing the principles discussed by Simonnard (13) result in a 45 to 50% reduction in cost for each re-optimization undertaken. The details of the application of these procedures are discussed in the next chapter.

METHODOLOGY, STRUCTURE AND ASSUMPTIONS BUILT INTO THE MODEL

This project involves the optimization of a model using standardized data for a six row machinery set. The model with the optimum basis is stored on tape with DD name PROBFILE. In a second program with the PROBFILE DD name changed to OLDPFILE and a new PROBFILE defined, the execution of a Marvel source program reads information from cards, punched directly from special input forms, to change the old model's resource and technological coefficients and to set up the revise arrays to be filed in communication form on a temporary disk file named ECON2. The linear programming step REVISE then revises the model taken from OLDPFILE with the data set on ECON2 placing the revised problem on PROBFILE. RESTORE uses the old basis, also found on OLDPFILE, to define a starting point for the optimization process in the PRIMAL step of execution. SETREP and REPORT then cause the M.P.S. REPORT GENERATOR source program to write out the output report.

The program used to optimize the six row machinery set program and to place the optimized program on tape appears in Appendix A. The Marvel source program used to setup the revision arrays appears in Appendix B. The Report Generator source program used to print out the solutions is presented in Appendix C. The program which controls the sequence of execution of the prior two programs and the re-optimization process is presented in Appendix D. This program henceforth will be called the master program.

Characteristics of the Model

The model was constructed to provide alternatives in the date of performance of land preparation, planting and harvesting phases of production for both corn and soybeans. Table 8 presents the alternative periods when fall and spring land preparation for corn can occur. Land preparation during these

Table 8. Corn land preparation periods

Fall	Spring
Sept. 25 - Oct. 5	Apr. 1-20
Oct. 6-15	Apr. 21-30
Oct. 16-25	May 1-10
Oct. 26 - Nov. 4	--
Nov. 5-14	--
Nov. 15-24	May 11-20
Nov. 25 - Dec. 4	May 21-30
Dec. 5-15	May 31 - June 9

periods has been restrained to days when weather and soil conditions are suitable for the operation to be performed. The land preparation is also restrained by transfer rows to limit land preparation operations so that they follow the former year's harvest. The field operations performed during the land preparation phase are; chop stalks, disk, spread P_2O_5 and K_2O apply anhydrous ammonia, plow and disk (once early). Special consideration was also given to the problem of erosion control by allowing the user to restrict, via the input forms, fall land preparation to a specified number of acres.

Table 9 presents the periods when planting can occur. Reductions in the yield potential for late performance have been imposed so that timeliness of operation is given consideration. Thus, should the labor supply and acreage planted force planting to be performed during the ten day period May 11-20, a reduction in yield of seven percent results on corn planted during that period. Field operations included in the planting phase are late secondary tillage (disking or field cultivation), planting and spike tooth harrowing. Late secondary tillage and the spike tooth harrowing are included in the planting phase because they are performed immediately before and after the planting operation.

Table 9. Planting periods for corn with yield reduction for late performance

Planting periods	Assumed potential yield reduction
Apr. 21-30	0%
May 1-10	2%
May 11-20	7%
May 21-30	15%
May 31 - June 9	30%

Periods for harvesting, hauling and storing are presented in Table 10. Again yield penalties have been imposed for late performance, but the moisture percentage (also summarized in the table) at the date of harvest has been adjusted such that consideration is given to field drying. Thus, the model permits early harvest at reduced field losses but appropriate mechanical drying costs are incurred as a result.

Cultivation and rotary hoeing requirements are accounted for in the planting activities with a distribution in labor, field time and tractor time requirements as represented in Table 11. Timeliness of performance of rotary hoeing and cultivation has not been given consideration. Thus, if corn were planted during the period April 21-30, the rotary hoeing and cultivation requirements of labor, field time and tractor time were fixed and no opportunity was provided for late performance. If planting occurred during the period April 21-30, one-half of the rotary hoeing would be performed during the period May 11-20, and one-half during May 21-30. The first half of the cultivation would occur during May 31-June 9 and the last half during June 10-19.

The structure of the soybean production activities are similar to those involved in producing corn. Periods when land preparation for soybean production can be performed are presented in Table 12. Operations included in the land preparation phase are disking, spreading P and K, plowing and disking (once early). Again fall land preparation is precluded

Table 10. Harvest periods with the associated reductions in yield potential and moisture percentages

Harvest dates	Planting dates Apr. 21-30	May 1-10	May 11-20	May 21-30	May 31 - June 9
Sept. 25 - Oct. 5	0.0[a] (27.3)[b]	0.1 (29.9)	0.5 (33.2)	0.9 (36.4)	1.6 (39.8)
Oct. 6-15	1.1 (22.5)	0.3 (24.5)	0.0 (26.8)	0.1 (30.1)	0.5 (33.6)
Oct. 16-25	2.8 (19.0)	2.2 (20.1)	1.4 (20.1)	1.4 (21.8)	0.1 (25.1)
Oct. 26 - Nov. 4	3.2 (18.3)	3.0 (18.4)	2.8 (19.0)	1.6 (21.4)	0.5 (24.1)
Nov. 5-14	3.4 (18.2)	3.1 (18.3)	3.0 (18.4)	2.8 (18.9)	2.1 (20.7)
Nov. 15-24	3.7 (18.1)	3.3 (18.2)	3.2 (18.3)	3.1 (18.3)	2.9 (18.6)
Nov. 25 - Dec. 4	4.0 (18.0)	3.7 (18.1)	3.5 (18.2)	3.3 (18.2)	3.1 (18.4)

[a]Field losses adapted from data by Marley and Ayres (12).

[b]Moisture percentages adapted from data by James (11).

Table 11. Breakdown on planting, rotary hoeing and cultivation, labor, field time and tractor time requirements for corn

	Apr. 21-30	May 1-10	May 11-20	May 21-30	May 31 - June 9
Apr. 21-30	P[a]				
May 1-10		P			
May 11-20	$\frac{1}{2}$RH[b]	$\frac{1}{4}$RH	P		
May 21-30	$\frac{1}{2}$RH	$\frac{1}{2}$RH	$\frac{1}{4}$RH	P	
May 31 - June 9	$\frac{1}{2}$C[c]	$\frac{1}{4}$RH+$\frac{1}{4}$C	$\frac{3}{4}$RH	$\frac{1}{2}$RH	P
June 10-19	$\frac{1}{2}$C	$\frac{1}{2}$C	$\frac{1}{2}$C	$\frac{1}{2}$RH+$\frac{1}{2}$C	RH
June 20 - Sept. 24		$\frac{1}{4}$C	$\frac{1}{2}$C	$\frac{1}{2}$C	C

[a]P stands for planting operations requirements.

[b]RH stands for rotary hoe requirements.

[c]C stands for cultivation requirements.

until after harvest of the prior year's crop on that acreage. Planting periods with the associated reductions in yield potential are presented in Table 13. Planting of soybeans was

Table 12. Land preparation schedule for soybeans

Fall	Spring
Oct. 6-15	Apr. 1-20
Oct. 16-25	Apr. 21-30
Oct. 26 - Nov. 4	May 1-10
Nov. 5-14	May 11-20
Nov. 15-24	May 21-30
Nov. 25 - Dec. 4	May 31 - June 9
Dec. 5-15	June 10-19

Table 13. Planting periods with estimated yield reductions for late planting

Planting periods	Yield reduction for late performance
May 1-10	0%
May 11-20	2%
May 21-30	7%
May 31 - June 9	15%
June 10-19	25%

not considered as an alternative during April 21-30 because 1. the normal soil temperature is usually too low for satisfactory soybean emergence and plant population and 2. the risk of frost kill is considered too great. An alternative planting period during June 9-19 was considered at a 25%

reduction in estimated yield potential. The operations performed during the planting phase include late secondary tillage (disking or field cultivation), planting, and harrowing. Harvest periods and yield reductions for late harvest are presented in Table 14. The number of harvest periods was limited to four because it was considered that field losses (.4 bushel/acre per day) would be uneconomical after November 14. Again, the field, tractor and labor requirements for rotary hoeing and cultivation are accounted for in the planting activities and have been distributed as presented in Table 15.

The field losses and penalties for late planting and harvesting summarized in Tables 9 and 10 and the moisture percentages of Table 10 have been structured into the model as illustrated in Figure 1. The moisture percentages, field losses, and penalties for late planting have been retained in percentage form to minimize the calculations and adjustment of coefficients by the Marvel input program. These steps were considered essential because the Marvel language sacrifices execution speed for versatility in programming.

With the moisture and field loss information entered simultaneously as illustrated in Figure 1, increased field losses are weighted against the reduced drying cost by permitting more in the field drying of corn. The two rows, FL and PSPLP, which account for field losses and reduction in potential yield, could be joined into one at some gain in computing efficiency

Table 14. Harvest periods and associated reductions in yield potential for soybeans

Harvest dates	Planting dates May 1-10	May 11-20	May 21-30	May 31 - June 9	June 10-19
Oct. 6-15	0.0	0.0	--	--	--
Oct. 16-25	5.7	3.0	0.0	0.0	--
Oct. 26 - Nov. 4	17.1	11.4	5.7	3.0	0.0
Nov. 5-14	28.5	22.8	17.1	11.4	5.7

Table 15. Breakdown on planting, rotary hoeing and cultivation labor, field time, and tractor time requirements for soybeans

	May 1-10	May 11-20	May 21-30	May 31 - June 9	June 10-19
May 1-10	P[a]				
May 11-20	1/4RH[b]	P			
May 21-30	1/2RH	1/4RH	P		
May 31 - June 9	1/4RH	1/2RH	1/3RH	P	
June 10-19	1/2C[c]	1/4RH+1/2C	2/3RH+1/3C	1/2RH	P
June 20 - Sept. 24	1/2C	1/2C	2/3C	1/2RH+C	RH+C

[a]P stands for planting operations requirements.

[b]RH stands for rotary hoe requirements.

[c]C stands for cultivation requirements.

Figure 1. Model structure to reduce yield for late planting or harvesting and to account for drying costs

FL_{i0j} is the field loss with planting in period i and harvesting in period j.

$PSPLP_i$ is the reduction in potential yield with late planting.

M_{i0j} is the number of acre moisture percentage points at harvest which is calculated ($100\% - FL_{i0j} - PSPLP_j$) times the percent moisture at the date of harvest.

Y is the expected yield if planted and harvested during optimal periods.

PLi is a corn planting activity in period i.

CHi0j is a corn harvesting activity in period j which was planted in period i.

L under "Row Type" designates a less than or equal to restraint.

E under "Row Type" designates an equality restraint.

PSPLP accounts for penalties incurred in late planting.

CD is a corn drying activity at a 1¢ cost per percent moisture per bushel.

CS is a corn selling activity-selling one bushel of number 2 corn at 15.5% moisture.

Row Type	Row Name	RHS	PL1	PL2	Activities CH101	CH102	CH201	CH202	FL	PSPLP	CD	CS
	C										-.01	1.10
L	USC1	0	-1		1	1						
L	USC2	0		-1			1	1				
E	FL	0			FL_{101}	FL_{102}	FL_{201}	FL_{202}	-1/y			
E	M	0			M_{101}	M_{102}	M_{201}	M_{202}			-1/y	-15.5/y
L	CGT	0			-y	-y	-y	-y	1	1		1
E	PSPLP	0	$PSPLP_1$	$PSPLP_2$						-1/y		

but the two have been separated for purpose of versatility when the model is expanded to the whole farm application and winter grazing of corn stalks is considered.

The model contains a similar structure to account for potential yield reductions and field losses in soybeans. However, all losses are entered in a single restraint. It was assumed that soybeans would be field dried, thus eliminating the need for a moisture accounting restraint.

Figure 2 is presented to illustrate the method and structure used to account for the corn production costs which fall into the following classifications:

1. fuel, repair and miscellaneous variable costs (FRM)
2. fertilizer
3. seed
4. herbicide and insecticide (HI)
5. custom hire
6. interest

A similar structure was used to account for costs in soybean production. Structuring the model in this form permits the transfer of information from the input to the output program and also sums costs within classes for presentation in the output report by presenting the levels of the cost accounting activities.

Figure 2. Model structure for cost accounting

LP1 is a land preparation activity with costs for fuel, oil, repair and miscellaneous expenses (C_{FRM}); fertilizer costs (C_{FER}) and custom hire costs (C_{LCH}) entered into the model for land preparation.

PL1 is a planting activity with costs for fuel, oil, repairs and miscellaneous expenses (C_{PFRM}); seed cost (C_{PS}); herbicide and insecticide costs (C_{PHI}); and custom hire costs (C_{PCH}) entered into the model for the planting and weed control phases.

CH101 is a harvesting activity with costs for fuel, oil, repairs and miscellaneous expenses (C_{HFRM}) and custom hire costs (C_{HCH}) entered into the model for the harvest phase.

CFRM is an activity for payment of fuel, oil, repairs and miscellaneous expenses incurred in production.

CFER is an activity for payment of fertilizer costs.

CS is an activity for payment of seed costs.

CHI is an activity for payment of herbicide and insecticide costs.

CHIRE is an activity for payment of custom hire costs.

CI is an activity charging interest on all variable expenses for production.

Row Name	RHS	LP1	PL1	CH101	Activities CFRM	CFER	CS	CHI	CHIRE	CI
C					-1	-1	-1	-1	-1	$-C_I$
FRM	0	$+C_{FRM}$	$+C_{PFRM}$	C_{HFRM}	-1					
FER	0	$+C_{FER}$				-1				
S	0		C_{PS}				-1			
HI	0		C_{PHI}					-1		
CHIRE	0	C_{LCH}	C_{PCH}	C_{HCH}					-1	
CI	0				1	1	1	1	1	-1

The set-aside program is structured as shown below in Figure 3.

Restraint Name	RHS B	B2	Activities DI20	MP
LDI	0	0	1	
DA20	.2CB	0	1	
CONB	CON	0		1

LDI is a transfer row for the land placed in set-aside acres.

DA20 is a restraint on the number of acres placed in set-aside at the price support payment rate.

CONB is a minimum restraint on the acreage put into conserving crops for set-aside participation.

CON is the conserving base acreage for set-aside participation.

B is a right-hand-side which forces participation in the set-aside program at a level equal to .2 times the corn base (.2CB).

B2 is a right-hand-side without set-aside participation.

DI20 is a set-aside program participation activity.

MP is a meadow production activity which meets the conservation base acreage requirements.

Figure 3. Structure of the set-aside program

The B and B2 columns make up the right-hand-side section for optimization of two plans. The B column elements for DA20 (set at two-tenths of the corn base) and CONB (set at the conservation base acreage) force a plan to be developed with participation in the set-aside program at the 20% level. The B2 column elements, set to zero, for the DA20 and CONB restraints result in a plan which does not permit participation. Thus, the two plans can be compared to make an economic evaluation of the set-aside program participation. However, if the farm planner does not wish to test the outcome of participation in the set-aside program, the B column DA20 and CONB coefficients are set equal to zero by the Marvel source program and only the plan without participation is reported. The Marvel program thus sets the element in row R1, column C1 of array $COMMUN (an array established to communicate with the master program) equal to 0.0, which passes to the master program as element XR1C1. This element is tested by the conditional transfer statement, IF(XR1C1.NE.1.0,OUT), to prevent the reporting of the B2 solution.

When the farm planner desires only the plan with participation reported, the B column elements, DA20 and CONB, are set to two-tenths of the corn base acreage and to the conservation base acreage respectively. Then the element in the $COMMUN array again is set to 0.0 which results in only the B solution (the participation solution) being reported.

The requirement of meadow to be established with a nurse crop has been structured into the model as illustrated in Figure 4. Structuring the model as illustrated prohibits meadow production unless oats or set-aside acres are produced to serve as a nurse crop. However, the set-aside and oats growing activities are permitted to enter the plan without meadow production. This structure permits the rotation organized after the plan is developed thus eliminating the inflexibilities associated with rigid pre-specified rotations.

Restraint Name	DI20	OP	MP
LTM	-N	-N	1.0

LTM is a maximum restraint permitting meadow to be established only if set-aside acres or oats enters.

DI20 is a set-aside activity.

OP is an oats production and harvesting activity.

MP is a meadow production and harvesting activity.

N is equal to the number of years meadow is in production before being re-established.

Figure 4. Model structure for meadow establishment with a nurse crop

ORGANIZATION OF INPUT INFORMATION

The purpose of this chapter is to discuss the information that must be entered into the model before an optimization can be attempted and the input forms which have been used to organize it.

The input forms have been divided into a title page and twenty-two sections.[1] Each section contains related input information which can be read by a single Marvel read statement. The data input format is presented in Appendix F. The title page of the input forms is organized for entry of the name and address of the farm planner, a brief description of the machinery set, and/or assumptions made in development of the input data.

In some sections, when considered helpful, suggested coefficients have been listed which are typical of the six row machinery set presented in Appendix G. Four, eight and twelve row machinery sets are also presented with suggested annual costs in Appendix G. Suggested coefficients are provided only as a guide and with the expectation that the farm planner would prefer to use, in whole or in part, information from his own records, where available. The model user should, even though he chooses to follow the standardized data, adjust the suggested coefficients for the machinery set appropriate to his farm

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[1]See Appendix E. for the input forms.

operation. A complete list of standardized operating costs and time requirements are given in Appendix H.

Section 1 entitled "General Information" was developed to collect several items of background material. The crop acreage presently under the farm operator's control should exclude pasture and waste land. The crop acreage entered may be either owned or rented. If the acreage is owned a charge (taxes and interest on investment) is entered to be used in calculation of management return. However, if the acreage is rented, a cash rent may be entered instead. If either owned or rented the depreciation, taxes and interest on investment, buildings and equipment should be included.

If the user wishes to evaluate the consequences of renting additional land and of hiring supplemental hourly labor, he should circle the "yes" responses and enter appropriate costs. When a "no" response is circled for either labor hiring or land renting, the input source program attaches a prohibitively large negative price to that option.

The fixed labor charge and annual machinery costs should be estimated only for that portion which arises from corn, soybean, oats, and hay production and set-aside participation. These data are used to calculate management return in a manner similar to that used with the tax and interest items entered for operated land.

Section 2, "Management Practices for Erosion Control" serves for input of information related to land use practices consistent with the prevention of excess soil erosion and of increased incidence of insect pests and disease which adversely affect estimated yields. The coefficients used to set restraints on soybeans, total rowcrops and meadow production should permit the development of rotations effective in control of erosion on both operated land and any land that might be added through renting. Entries are also provided for restraining the amount of fall plowing permitted in the optimized farm plan both on operated land and land to be rented.

The price expectations entered in Section 3 should reflect the place and time of sale. Even though straw and hay are used on the farm, the users estimate of their market value should be entered as their price.

As stated on the input forms in section 4, the yield expectations for corn and soybeans should assume 1. average weather conditions and 2. that planting and harvesting are performed when the highest yields can be attained. Because no provisions are made in the model for the influence of timeliness of operations on yield, the harvested yields reported for oats, straw and hay will be the same as the estimates the user provides.

Sections 5 and 6 "Variable Costs of Production of Corn" and "Variable Costs of Production of Soybeans", provide for entry of all fuel, oil, repairs and other miscellaneous variable cost by field operation. If equipment is rented or machine services hired the appropriate costs should be entered under custom hire. Spaces have been provided for entry of fertilizer and lime, herbicide and insecticide, and seed costs.

Sections 7 and 10, "Labor Requirements for the Production of Corn" and "Labor Requirements for the Production of Soybeans" require entry of the labor requirements including operation and lubrication time plus down time for repairs even though this work may be performed during days unsuitable for field operation. The estimates should also include time for procuring the necessary inputs such as repairs and fertilizer. However, Sections 8 and 11, "Man Hours of Field Time Required for the Production of Corn" and "Man Hours of Field Time Required for the Production of Soybeans", should include only the direct time requirements during suitable field days. Thus time for making repairs which can be delayed until a day unsuitable for field work should not be included. Lubrication which can be performed on such days also should be excluded in the estimates of sections 8 and 11.

The tractor requirements in sections 9 and 12 are the same as man hours of field time with two exceptions. Although a power unit and its operator may not be steadily employed in hauling harvested grain, it may not be economically feasible to employ this tractor in fall tillage operations even though it is feasible for the tractor's operator to man a second tractor in fall tillage. Under such circumstances the man hours of field time required for hauling are treated as equal to the time actually consumed in hauling but the tractor time requirements will be adjusted to equal that required of the harvesting machine where actual requirements are less than harvest time requirements. Also, if a pull-type or mounted harvester is employed, tractor time used to power the harvester should be added to tractor time used in hauling since in neither case will the tractor be available for fall tillage.

Section 13, "Variable Costs for Production of Oats", follows a pattern similar to that used for corn and beans with the exception of the entry which deals with the cost of additional hired labor for baling straw. Section 14, "Time Requirements for Production of Oats", requires information similar to that defined for sections 7-12.

Section 15, "Variable Cost for Production of Hay", demands special attention because of the biennial or perennial nature of the hay crop. First, the user must give the years meadow will be left in production. If the production period is two years as presented in section 15 of the input forms, fuel, oil, repairs and miscellaneous variable costs for operating the packer seeder, spreading fertilizer and clipping stubble are amortized over two years of production. A similar pattern is followed with time requirements (section 16).

Sections 17 and 18 permit the farm planner to enter information related to the set-aside program. If the planner desires to have the participation plan reported, he may also arrange to have a report on the optimum plan without participation for purposes of comparison. The answers to questions

1 and 3 result in the input source program structuring the appropriate right-hand-side columns as discussed in Figure 3 of chapter 3.

If the participation solution is desired then the corn base, the price support payment and the conservation base on operated land plus the costs and time requirements of section 18 must be supplied.

Section 19 seeks to obtain from the user an estimate of the daily supply of labor available including that of the operator, his family and any full time hired labor, for each of the sixteen time periods defined. The length of work week is also required for input. If a six or seven day work week is desired for planning purposes, the appropriate response should be circled. As stated in section 19, all down time for major repairs should be excluded. If livestock is a part of the farm operation then labor availability estimates for crop production should reflect the presence of a livestock operation.

The estimates in sections 20, 21 and 22 should reflect the number of hours tractors and harvest units would normally be operated on a day suitable for field work. These estimates must include only the time someone is willing to operate the machinery and must exclude all down time except small necessary on-the-spot repair.

OUTPUT FROM THE PRODUCER ORIENTED PROGRAM WITH AN EXAMPLE

The I.S.U. test farm, a hypothetical unit used as an example in this section, is composed of 600 tillable acres. A fixed charge of $40 per acre is assessed to cover interest on investment and taxes on land and buildings. It is also assumed that more land can be rented for $40 per acre and that more labor can be hired at $2.00 per hour. The return imputed to fixed labor (operator, family labor and one full time hired man) allocated to crop production is $12,000. The six row machinery set described in Appendix G results in annual fixed machinery expenses of $10,199.64 Variable expenses and labor, field, and tractor time requirements associated with the I.S.U. test farm are represented by the suggested coefficients on the input forms in Appendix E. Labor and equipment resources available for crop production are also presented in the input forms (see Sections 19-20). The set-aside price support payment is assumed to equal $96 per acre on 20% of a 420 acre corn base. A conservation base of zero acres is also assumed. Additional assumptions are as follows:

1. At maximum only 300 of the 600 acres of land presently operated can be planted to soybeans.
2. All 600 acres presently operated can be fall plowed and 100% of any land which may be rented can be fall plowed.
3. A 5 percent reduction in corn yield is specified for spring plowing.

The Optimal Farm Plan with Set-Aside Participation

The plan derived with participation in the set-aside program has income of $9,782.52 from 117.60 acres of soybeans averaging 36.64 bushels per acre, $76,709.29 from 574.78 acres of corn averaging 123.57 bushels per acre, $8,064.00 from the 84 acres placed in the set-aside program, and $9,556.11 in oat sales. An additional $2,540.57 results from selling the straw from the 178.29 acres of oats in the plan. Total sales of $106,652.49 are realized from the optimal plan which includes set-aside participation at the 20% level.

The variable soybean production expenses are $650.35 for fuel, oil, repairs and miscellaneous variable expenses, $635.07 for fertilizer, $470.42 for herbicide, $470.32 for seed, and $89.05 for interest on variable capital. The total expense allocable to soybean production is $2,315.31. Corn production costs include $4,684.45 for fuel, oil and repairs, $10,346.02 for fertilizer, $3,448.67 for herbicides and insecticides, $2,873.89 for seed, $4,225.56 for drying (or dockage if not dried), and $854.12 for interest on variable capital. Total corn production expenses equal $26,432.71 for the 546.19 acres. The set-aside acres resulted in expenses of $119.28 for fuel, oil and repair costs and $117.60 for seed costs. Oats production expenses include: $652.53 for fuel, oil, repairs, and miscellaneous variable costs, $802.29 for fertilizer, $445.71 for seed, $365.49 for machine hire (straw baling), $303.09 for labor allocable to straw baling, and $102.76 for interest on variable capital. Hence expenses, totalling $2,671.86 are charged for oat and straw production. Because no hay is produced, no hay production costs are incurred. Labor costs which cannot be directly allocated to any particular crop equal $970.84.

Variable costs of production for all activities total $32,627.59. When this amount is subtracted from total sales of $106,652.49, results in a return over variable costs of $74,024.90. When annual machinery costs of $10,199.64, annual labor costs of $12,000 and a land charge of $24,000 (for presently operated land) plus $14,186.76 (for rented land) are subtracted from this figure a return to management of $13,638.49 results.

The schedule of field operations is summarized in Tables 16 through 18. The land preparation schedule for both corn and soybeans has been summarized in Table 16. The five percent reduction in estimated potential yield associated with spring plowing and the shortage of available tractor time for field use prohibits spring land preparation for corn production. The 262.29 acres prepared prior to Sept. 24 are those acres designated for oats production and set-aside participation. The early harvest of oats and structure of the set-aside activities permit earlier fall land preparation to reduce the dependence on spring land preparation. Oats, normally considered a crop with less profit potential than corn

Table 16. Schedule of land preparation for corn and soybeans

Land preparation periods	Soybeans (acres)	Corn (acres)
(Fall periods)		
June 20 - Sept. 24	0.00	262.29
Sept. 25 - Oct. 5	0.00	53.86
Oct. 6-15	0.00	14.95
Oct. 16-25	57.80	50.44
Oct. 26 - Nov. 4	0.00	52.12
Nov. 5-14	0.00	47.91
Nov. 15-24	0.00	44.35
Nov. 25 - Dec. 4	0.00	27.91
Dec. 5-15	0.00	20.96
(Spring periods)		
Apr. 1-20	0.00	0.00
Apr. 21-30	0.00	0.00
May 1-10	0.00	0.00
May 11-20	0.00	0.00
May 21-30	39.36	0.00
May 31 - June 9	20.44	0.00
June 10-19	0.00	--[a]

[a]Land preparation for corn during June 10-19 was not considered as an alternative.

or soybeans, in this example permits an increase in the total acreage operated plus an increase in corn acreage.

The planting schedule derived for oats, set-aside acres, corn and soybeans is shown in Table 17. As illustrated the results are consistent with the common practices of planting corn early and then shifting to soybean planting during mid-May. In Table 18 the harvest schedule provides that the farm operator begin fall harvesting of corn early and utilize drying facilities. This permits the operator to continue

Table 17. Planting schedule with program participation

Periods	Oats[a] (acres)	Set-Aside[a] (acres)	Corn[b] (acres)	Soybeans[c] (acres)
Apr. 1-20	178.29	84.0	--	--
Apr. 21-30	--	--	206.05	--
May 1-10	--	--	196.43	0.00
May 11-20	--	--	172.30	0.00
May 21-30	--	--	0.00	97.16
May 31 - June 9	--	--	0.00	20.44
June 10-19	--	--	--	0.00

[a]Oats and set-aside acreage seeding are permitted only during Apr. 1-20.

[b]Corn planting from Apr. 1-20 and June 10-19 also are not considered as alternative planting periods.

[c]Planting soybeans from Apr. 1-20 and Apr. 21-30 are not considered as alternative planting periods.

Table 18. Harvest schedule for corn and soybeans

Harvest dates	Planting dates April 21-30 (acres)	May 1-10 (acres)	May 11-20 (acres)	May 21-30 (acres)	May 31 - June 9 (acres)
Sept. 25 - Oct. 5	110.10	0.00	0.00	0.00	0.00
Oct. 6-15	95.94	5.16	0.00	0.00	0.00
Oct. 16-25	0.00	11.43	0.00	97.16[a]	20.44[a]
Oct. 26 - Nov. 4	0.00	106.53	0.00	0.00	0.00
Nov. 5-14	0.00	73.32	24.61	0.00	0.00
Nov. 15-24	0.00	0.00	90.65	0.00	0.00
Nov. 25 - Dec. 4	0.00	0.00	59.04	0.00	0.00

[a]Represents the harvested acreages of soybeans.

fall land preparation which was begun earlier on land planted to oats and in set-aside. Once the soybeans are sufficiently dry in the field for harvest, corn harvest stops and soybean harvest proceeds until completion; then corn harvest resumes.

A review of the resource utilization and shadow prices for tractor time, harvest equipment time, field time and labor yields insight into what factor or factors limit the farm plan. A summary of tractor use and availability is presented in Table 19. The last column gives an estimate of the income

Table 19. Tractor availability, use and valuation

Time periods	Tractor hours used	Tractor hours available	Income change from one less hour 1
(Spring)			
Apr. 1-20	184.32	184.32	22.14
Apr. 21-30	117.24	117.24	37.13
May 1-10	111.77	111.77	31.47
May 11-20	122.38	122.38	21.51
May 21-30	126.17	126.17	4.23
May 31 - June 9	114.10	115.54	--
(Fall)			
Sept. 25 - Oct. 5	149.74	149.74	4.23
Oct. 6-15	137.50	137.50	4.23
Oct. 16-25	140.21	140.21	4.23
Oct. 26 - Nov. 4	144.88	144.88	4.23
Nov. 5-14	133.18	133.18	4.23
Nov. 15-24	123.29	123.29	4.23
Nov. 25 - Dec. 4	77.58	77.58	4.23
Dec. 5-15	29.14	29.14	4.23

sacrificed with one less hour of tractor time available for field work. One can observe from the table that an extra hour of tractor time for corn planting during April 21-30 is worth \$37.13 and an hour from May 11-20, \$21.51. This variation results from the differences in potential yields as related to timeliness of operation; thus, the shadow price is the productivity of an hour of tractor use in performing the required tillage, planting, and weed control practices in the production process. The \$4.23 shadow price indicates the value at the margin of tillage and soybean planting operations.

The availability and use of self-propelled harvest equipment is summarized in Table 20. The last column also provides

Table 20. Harvest equipment availability, use and valuation

Time periods	Harvesting equipment hours used	Equipment hours available	Value of the last hour (dollars)
(Fall)			
Sept. 25 - Oct. 5	74.87	74.87	9.23
Oct. 6-15	68.75	68.75	16.30
Oct. 16-25	70.10	70.10	20.78
Oct. 26 - Nov. 4	72.44	72.44	22.30
Nov. 5-14	66.59	66.59	22.28
Nov. 15-24	61.64	61.64	22.05
Nov. 25 - Dec. 4	38.79	38.79	21.62

an estimate of the value of the last hour of this machine service to the farm business. Because field drying is more profitable than mechanical drying in the early harvest season the shadow prices (value of marginal productivity on harvest equipment) increase until the Oct. 26 - Nov. 4 period when field drying slows and field losses accelerate to off-set mechanical drying costs.

Although the shadow prices on harvesting machines reported here are not extremely high, an increase in the efficiency of harvesting, which would allow added acres of corn and soybean production, could result in shadow prices of $50.00 per hour or more.

Table 21 provides a summary of the labor resources available and used in the plan. Included are estimates for total labor, labor on days unsuitable for field work, and labor available only during days suitable for field work. Total labor hours available are not restrictive during any of the periods in this example, thus resulting in a zero return being imputed to the last hour for each of the periods presented (see the column "Value of last hour" under "Total labor" of Table 21). However, the field time on days suitable for field work is restrictive in all periods except from May 31 to June 9. As a result a shadow price of $2.00 attaches to the last hour available during each period (see "Value of the last hour" column under "Field time labor on suitable field day" of Table 21). The $2.00 per hour equals the marginal cost which in this

Table 21. Labor resources and valuation

Time periods	Operator hours worked	Total labor Operator hours available	Value of last hour (dollars)
(Spring)			
Apr. 1-20	211.05	308.88	0.00
Apr. 21-30	143.20	171.60	0.00
May 1-10	133.85	171.60	0.00
May 11-20	142.70	171.60	0.00
May 21-30	142.96	171.60	0.00
May 31 - June 9	121.63	205.92	0.00
June 10-19	122.06	205.92	0.00
(Summer)			
June 24 - Sept. 24	774.15	1912.68	0.00
(Fall)			
Sept. 25 - Oct. 5	166.17	188.40	0.00
Oct. 6-15	152.63	171.60	0.00
Oct. 16-25	136.52	171.60	0.00
Oct. 26 - Nov. 4	152.16	163.02	0.00
Nov. 5-14	139.86	163.02	0.00
Nov. 15-24	129.48	163.02	0.00
Nov. 25 - Dec. 4	81.47	163.02	0.00
Dec. 5-15	31.14	178.98	0.00

[a]No restraints were defined for the June 10-19 and June 24 - Sept. 24 periods because field time was assumed to be unrestrictive thus providing little additional information.

Field time labor on suitable field days: Operator hours worked	Operator hours available	Value of last hour (dollars)	Hourly hired labor: Hours hired
179.47	179.47	2.00	4.85
117.24	117.24	2.00	0.00
109.10	109.10	2.00	2.67
119.47	119.47	2.00	2.91
123.16	123.16	2.00	3.01
114.10	137.55	0.00	0.00
--[a]	--[a]	--[a]	0.00
--[a]	--[a]	--[a]	0.00
144.39	144.39	2.00	71.41
132.59	132.59	2.00	65.57
133.52	133.52	2.00	75.88
131.08	131.08	2.00	77.72
120.49	120.49	2.00	71.45
111.54	111.54	2.00	66.14
70.18	70.18	2.00	41.63
26.95	26.95	2.00	2.19

case is $2.00 per hour, the wage assumed for an hour of hired labor. In the last column of Table 21 a schedule of the hours of supplementary labor hired is provided.

A Comparison of the Optimum Farm Plans, Set-Aside Participation and Non-Participation

By answering questions 1 and 3 in section 17 "yes", the plans with and without set-aside participation are reported for comparison. The results presented below are summarized from the output reports shown in Appendix I.

Table 22 gives a comparative summary of income and expenses

Table 22. Income and expenses summary for the participation and non-participation plans

	Participation (dollars)	Non-participation (dollars)
Income source		
Soybean sales	9,782.52	8,481.35
Corn sales	76,709.29	76,661.12
Oat sales	9,556.11	12,830.59
Straw value or sales	2,540.57	3,411.12
Set-Aside payments	8,064.00	0.00
Total income	$106,652.49	$101,384.17
Expenses		
Soybeans	2,315.31	2,015.08
Corn	26,432.71	26,296.92
Oats	2,671.86	3,587.39
Set-Aside	236.88	0.00
Hired labor costs	970.84	954.67
Total variable costs	$ 32,627.59	$ 32,454.07
Returns over variable costs	$ 74,024.90	$ 68,530.10
Returns to management	$ 13,638.49	$ 9,670.06

derived in both plans. The $3,968.43 difference in the management returns can be attributed to three important factors. First, the returns from the acreage placed in set-aside are high considering the low costs involved in seeding and clipping. Second, the early plowing permitted on set-aside acres result in an increased acreage planted in soybeans. Third, because of the fall plowing higher average yields for corn and soybeans are achieved, even with the increase in soybean production[1]. Although there is a difference in the acreages of soybean production, the planting and harvest schedules are similar under the two plans.

Table 23. Crop production acreages for the participation and no participation plans

Crop	Participation		No participation	
	Acres planted	Average yield (per acre)	Acres planted	Average yield (per acre)
Soybeans	117.60	36.64 bu.	102.35	36.50 bu.
Corn	574.78	123.57 bu.	574.78	123.50 bu.
Oats grain	178.29	80.00 bu.	239.38	80.00 bu.
Oats straw		.75 ton		.75 ton
Set-Aside	84.00	--	0.00	--

[1]See Table 23 for a comparison of crop production and yield under each plan.

A brief comparison of the shadow prices on the tractor and harvest equipment time offers insight into the relative differences in limitations of the two plans. The shadow prices reported in Tables 24 and 25 for participation and non-participation provide an estimate of the relative value at the margin of tractor and harvest equipment services under the two plans. The higher shadow prices on harvest equipment for the participation plan means that the harvest equipment is more restrictive. Likewise, the non-participation plan is more severely restricted by tractor time in performance of fall tillage operations as indicated by the higher shadow prices reported on fall tractor time.

As illustrated in this section the model is designed to suggest which resources and services limit the plan and to provide estimates of the value of an additional hour of the limiting factors.

Table 24. Valuation of last hour of tractor time available for program participation and non-participation plans

Period	Participation	Non-participation
	(dollars)	
(Spring)		
Apr. 1-20	22.14	27.18
Apr. 21-30	37.13	36.51
May 1-10	31.47	32.72
May 11-20	21.51	23.06
May 21-30	4.23	7.02
May 31 - June 9	0.00	2.93
(Fall)		
Sept. 25 - Oct. 5	4.23	7.02
Oct. 6-15	4.23	7.02
Oct. 16-25	4.23	7.02
Oct. 26 - Nov. 4	4.23	7.02
Nov. 5-14	4.23	7.02
Nov. 15-24	4.23	7.02
Nov. 25 - Dec. 4	4.23	7.02
Dec. 5-15	4.23	7.02

Table 25. Valuation of the last hour of harvest time available for program participation and non-participation plans

Period	Participation	Non-participation
	(dollars)	
Sept. 25 - Oct. 5	9.23	0.00
Oct. 6-15	16.30	7.07
Oct. 16-25	20.78	10.30
Oct. 26 - Nov. 4	22.30	11.82
Nov. 5-14	22.28	11.79
Nov. 15-24	22.05	11.57
Nov. 25 - Dec. 4	21.62	11.13

APPLICATIONS AND FUTURE RESEARCH NEEDS

As illustrated in the I.S.U. test farm example, the farm planner can determine the most profitable level of land renting and labor hiring in development of the optimum combination of crop production. By re-optimizing with the labor hiring and/or land renting options circled "no", plans without labor hiring and/or land renting may be obtained for comparison.

The model can also be used to compare farm leasing systems given a machinery set and adequate operating capital. By entering the tenants' share of the crops and expenses for each of the leasing systems, the outcome of optimal plans can be compared under crop share and cash renting arrangements. Both of these systems can be compared with owning land, by optimizing with coefficients appropriate to ownership and with exclusion of the renting option.

The influence of the machinery set on the optimal farm plan may be investigated by developing several plans entering the appropriate input-output coefficients and fixed costs for each machinery combination considered.

Although, the model at its present stage of development is applicable in meeting many planning needs, several extensions and modifications could widen the range of its applicability.

One such extension would be the development of separate models applicable to narrowly defined production regions. In this way suitable field days and alternative dates for performance of field operations could be made more specific to the weather and soils of the region. Field losses and moisture percentages also could be defined more precisely for each producing region.

Presently the number of weather and soil suitable field days are defined as the minimum one could expect in nine out of ten years. Further attention should be given to the consequences of over-extension of capacity during the one year in ten during which one could expect unfavorable weather and soil conditions. Two approaches could be taken to this problem. The first would be to optimize with coefficients appropriate to the unfavorable conditions one expects during the tenth year. The outcome could then be compared with the plans resulting from normal weather coefficients. The second approach would be to force the "normal" levels of production of each crop using coefficients which simulate the fewer suitable field days and poorer weather conditions for field drying one could expect in the tenth year. The lower yields arising from late planting, increased field losses associated with late harvest, discounts for marketing high moisture crops and/or increased drying costs would be reflected in lower income.

Adding livestock activities to the model would extend greatly its usefulness. On most Corn Belt farms, cropping activities must compete with livestock production. The latter may be scheduled to require intensive use of labor during periods of low labor productivity in crop production. Thus, livestock activities can have strong influences on optimal farm size and the optimum level of each crop activity. In particular on farms limited to crop production where farm size is very large or renting of additional land is a realistic alternative, the marginal productivity of labor may be pushed to a lower level on the last acres put into crop production than would be in a late May-early June swine farrowing enterprise or a similarly scheduled livestock activity. Because livestock activities are not now included in the model, livestock-crop interactions can not be investigated.

One further area in which more research would be highly productive is collecting more accurate input-output coefficients. Better information is needed on tractor and harvest equipment time requirements, field time requirements of machine operators and labor requirements, the number of weather and soil related suitable field days, moisture percentage at harvest and the accumulated field losses at the date of harvest. More accurate input coefficients in the above areas are essential for progress toward more reliable results from the application of farm planning models.

ACKNOWLEDGEMENTS

The author appreciatively acknowledges the guidance and suggestions of Dr. Raymond R. Beneke during the preparation of this thesis.

Thanks is extended to my wife, Mary, for the encouragement and understanding which were also essential for completion of this thesis.

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APPENDIX A: M.P.S. PROGRAM FOR PUTTING THE STANDARDIZED SIX ROW MACHINERY SET PROBLEM ON TAPE

```
//JOBNAME   JOB   'ACCT#,TIME=3,SIZE=128K',PROGRAMMER
//STEP1   EXEC   MPS360,REGION.MPSEXEC=128K
//MPSCOMP.SYSIN DD *
          PROGRAM
          INITIALZ
          MOVE(XDATA,'PROB1')
          MOVE(XPBNAME,'PBFILE')
          MVADR(XDONFS,NOF)
          MVADR(XDOUNB,OUT)
          MVADR(XMAJERR,OUT)
          CONVERT
          SETUP('MAX')
          SETREP
          MOVE(XRHS,'B')
          MOVE(XOBJ,'C')
          CRASH
          PRIMAL
          SAVE('NAME','RFILE')
          REPORT
          MOVE(XRHS,'B2')
          RESTORE('NAME','RFILE',1)
          PRIMAL
          REPORT
          EXIT
NOF       TRACE
OUT       EXIT
          PEND
/*
//MPSEXEC.STEPLIB   DD   DSNAME=SYS1.MPSMVT,DISP=SHR
//           DD   DSNAME=PROG.U9123MVL,DISP=(SHR,PASS)
//           DD   DSNAME=PROG.U9123RGP,DISP=(SHR,PASS)
//MPSEXEC.PROBFILE   DD   UNIT=TAPE,DSNAME=SEQ.U3104RWW,LABEL=(,NL),      X
//     DISP=(OLD,KEEP),VOLUME=SER=TP0347
//MPSEXEC.REPFILE    DD   UNIT=TAPE,DSNAME=SEQ.U3104RWW,LABEL=(1,NL),     X
//     DISP=(OLD,KEEP),VOLUME=SER=TP0535
//MPSEXEC.OBJ1   DD UNIT=TAPE,DSNAME=SEQ.U3104RWW,LABEL=(2,NL),           X
//     DISP=(OLD,KEEP),VOLUME=SER=TP0535
```

```
//MPSEXEC.REPWORK  DD  UNIT=SYSDA,SPACE=(CYL,(3),,CONTIG)
//MPSEXEC.SYSIN DD *
```

DATA SET (STANDARD IBM-MPS FORMAT)

```
/*
```

APPENDIX B: MARVEL SOURCE PROGRAM FOR DATA INPUT

```
PREPRO SAMPROB1,PRINT
ARRAY T2, ROWCNT=4, COLCNT=1
ARRAY DATA, ROWCNT=35,COLCNT=17,COLS CH(A,8,Z) SBH(A,8,Z)          C
LP(A,8,Z) LR(A,8,Z) FTR(A,8,Z) TFTR(A,8,Z) P(A,8,Z) HL(A,8,Z)      C
HF(A,8,Z) HTF(A,8,Z) HHF(A,8,Z) SLP(A,8,Z) SP(A,8,Z) SHL(A,8,Z)    C
SHM(A,8,Z)   SHT(A,8,Z) SHH(A,8,Z)
ARRAY VC, ROWCNT=2 , COLCNT=10
ARRAY T, ROWCNT=8 , COLCNT=5
ARRAY INFO, ROWCNT=6,COLCNT=2,COLS PER DI(A,8,Z)
ARRAY YIELD, ROWCNT=5 ,COLCNT=2
ARRAY REVIZE ,ROWCNT=1,COLCNT=1,ROWS STU, COLS XDATA(A,8)
ARRAY SECTION,ROWCNT=1,COLCNT=1,COLS XDATA(A,8), ROWS STU
ARRAY ROWS, COLCNT=1,ROWCNT=1, COLS TYPE1(A,2)
ARRAY COLL  , ROWCNT=47, COLCNT=15
ARRAY COLS,ROWCNT=26, COLCNT=10
ARRAY COLC,ROWCNT=1,  COLCNT=10
ARRAY COLG,ROWCNT=7 , COLCNT=5
ARRAY COLT,ROWCNT=47, COLCNT=16
ARRAY COLSH, ROWCNT=19 , COLCNT=16
ARRAY COLCH,  ROWCNT=31, COLCNT=35
ARRAY COLD,ROWCNT=8 , COLCNT=1
ARRAY COLRNT, ROWCNT=5 , COLCNT=1
ARRAY COLO,ROWCNT=12, COLCNT=1
ARRAY COLH,ROWCNT=14, COLCNT=1
ARRAY RHS, ROWCNT=70,COLCNT=2
ARRAY REVISE , ON ECON2
ARRAY DSCRPT, ROWCNT=2,COLCNT=1,ROWS NAME LOCAT,COLS DISC(A,72,Z)
READ,TABULAR
FORMAT FMT1, DATA (F1,W72,L) (/)(F1,W72,L)
READ, FORMAT FMT1, CARDCNT=2, DATA (DSCRPT,NAME,DISC) (DSCRPT,     C
LOCAT,DISC)
WRITE,FORMAT FMT1, DATA (DSCRPT,NAME,DISC) (DSCRPT,LOCAT,DISC)
ERASE, FORMAT FMT1
FORMAT FMT1,DATA (F1,W10,D2) 6(W10,D2) (/) (F1,W10,D2) 6(W10,D2)
FORMAT FMT4, DATA (F1,W10,D2) (W10,D2) (W10) (W10,D2) (W10)        C
2(W10,D2) (/) (F1,W10,D2)
READ,FORMAT FMT4, CARDCNT=2,  DATA (RHS,L1,B) (INFO,RENT,PER)      C
```

```
      (INFO,RENT,DI) (INFO,PAR,PER)  (INFO,HIRE,DI) (COLC,C,TLHC) (RHS,C
      FXCL,B) (RHS,FXCM,B)
      WRITE,FORMAT FMT4,             DATA (RHS,L1,B) (INFO,RENT,PER)    C
      (INFO,RENT,DI) (INFO,PAR,PER)  (INFO,HIRE,DI) (COLC,C,TLHC) (RHS,C
      FXCL,B) (RHS,FXCM,B)
      ERASE , FORMAT FMT4
      FORMAT FMT4 , DATA (F1,W10,D2) 6(W10,D2)
      READ, FORMAT FMT1 ,   CARDCNT=2,   DATA (RHS,MRSB,B) (RHS,MRRC,B)C
      (RHS,MRFP,B) (RHS,CONR,B) (INFO,PRCNTR,PER) (T,CH,MP) (T,CH,MPL) C
      (T,CH,MRH) (T,CH,MC)
      WRITE,FORMAT FMT1 ,                DATA (RHS,MRSB,B) (RHS,MRRC,B)C
      (RHS,MRFP,B) (RHS,CONR,B) (INFO,PRCNTR,PER) (T,CH,MP) (T,CH,MPL) C
      (T,CH,MRH) (T,CH,MC)
      (RHS,FXCLND,B)=(INFO,RENT,PER)*(RHS,L1,B)
      IF((INFO,HIRE,DI).EQ.'YES') , GO TO CK42
      (COLC,C,TLHC)=-1000.
      GO TO CK41
CK42  (COLC,C,TLHC)=-1.0 * (COLC,C,TLHC)
CK41  IF((INFO,RENT,DI).EQ.'NO'),GO TO CH4
      (COLRNT,C,RNTLND)=-1.0 * (INFO,PAR,PER)
      (COLRNT,MRFP,RNTLND)=-.01 * (T,CH,MRH)
      (COLRNT,MRRC,RNTLND)=-.01 * (T,CH,MPL)
      (COLRNT,MRSB,RNTLND)=-.01 * (T,CH,MP)
      (COLRNT,CONR,RNTLND)=-.01 * (T,CH,MC)
      GO TO CH5
CH4   (COLRNT,C,RNTLND)=-1000.0
CH5   READ , FORMAT FMT4, CARDCNT=1, DATA  (COLG,C,CS) (COLC,C,SSELL)  C
      (COLC,C,OSELL) (COLC,C,STRSELL) (COLC,C,HSELL)
      WRITE, FORMAT FMT4,              DATA  (COLG,C,CS) (COLC,C,SSELL)  C
      (COLC,C,OSELL) (COLC,C,STRSELL) (COLC,C,HSELL)
      READ, FORMAT FMT4, CARDCNT=1, DATA (YIELD,CORN,MGR) (YIELD,SB,MGRC
      ) (YIELD,O,MGR) (YIELD,STR,MGR) (YIELD,HAY,MGR)
      WRITE,FORMAT FMT4,             DATA (YIELD,CORN,MGR) (YIELD,SB,MGRC
      ) (YIELD,O,MGR) (YIELD,STR,MGR) (YIELD,HAY,MGR)
      READ, FORMAT FMT1,CARDCNT=2, DATA (VC,CORN,MPFRM)                 C
      (VC,CORN,MPLFRM) (VC,CORN,MHFRM) (VC,CORN,MFER) (VC,CORN,MHI)     C
      (VC,CORN,MS) (VC,CORN,MI) (VC,CORN,MCP) (VC,CORN,MCPL) (VC,CORN,  C
```

```
      MCH)
      WRITE,FORMAT FMT1,           DATA (VC,CORN,MPFRM)                    C
      (VC,CORN,MPLFRM) (VC,CORN,MHFRM) (VC,CORN,MFER) (VC,CORN,MHI)        C
      (VC,CORN,MS) (VC,CORN,MI) (VC,CORN,MCP) (VC,CORN,MCPL) (VC,CORN,     C
      MCH)
C NOW READ THE VARIABLE COSTS FOR SOYBEANS
      READ,FORMAT FMT1, CARDCNT=2,DATA (VC,SB,MPFRM) (VC,SB,MPLFRM)        C
      (VC,SB,MHFRM) (VC,SB,MFER) (VC,SB,MHI) (VC,SB,MS) (VC,SB,MI)         C
      (VC,SB,MCP) (VC,SB,MCPL) (VC,SB,MCH)
      WRITE,FORMAT FMT1,          DATA (VC,SB,MPFRM) (VC,SB,MPLFRM)        C
      (VC,SB,MHFRM) (VC,SB,MFER) (VC,SB,MHI) (VC,SB,MS) (VC,SB,MI)         C
      (VC,SB,MCP) (VC,SB,MCPL) (VC,SB,MCH)
      READ , FORMAT FMT1,CARDCNT=1,DATA  (T,CL,MP) (T,CL,MPL)(T,CL,MRH)C
      (T,CL,MC) (T,CL,MH)
      WRITE, FORMAT FMT1,          DATA  (T,CL,MP) (T,CL,MPL)(T,CL,MRH)C
      (T,CL,MC) (T,CL,MH)
      READ , FORMAT FMT1,CARDCNT=1,DATA  (T,CM,MP) (T,CM,MPL)(T,CM,MRH)C
      (T,CM,MC) (T,CM,MH)
      WRITE, FORMAT FMT1,          DATA  (T,CM,MP) (T,CM,MPL)(T,CM,MRH)C
      (T,CM,MC) (T,CM,MH)
      READ, FORMAT FMT1, CARDCNT=1, DATA (T,CT,MP) (T,CT,MPL) (T,CT,MRHC
      ) (T,CT,MC) (T,CH,MH) (T,CT,MH)
      WRITE,FORMAT FMT1,           DATA (T,CT,MP) (T,CT,MPL) (T,CT,MRHC
      ) (T,CT,MC) (T,CH,MH) (T,CT,MH)
      READ , FORMAT FMT1,CARDCNT=1,DATA  (T,SL,MP) (T,SL,MPL)(T,SL,MRH)C
      (T,SL,MC) (T,SL,MH)
      WRITE, FORMAT FMT1,          DATA  (T,SL,MP) (T,SL,MPL)(T,SL,MRH)C
      (T,SL,MC) (T,SL,MH)
      READ , FORMAT FMT1,CARDCNT=1,DATA  (T,SM,MP) (T,SM,MPL)(T,SM,MRH)C
      (T,SM,MC) (T,SM,MH)
      WRITE, FORMAT FMT1,          DATA  (T,SM,MP) (T,SM,MPL)(T,SM,MRH)C
      (T,SM,MC) (T,SM,MH)
      READ, FORMAT FMT1,CARDCNT=1, DATA (T,ST,MP) (T,ST,MPL) (T,ST,MRH)C
      (T,ST,MC) (T,SH,MH) (T,ST,MH)
      WRITE,FORMAT FMT1,           DATA (T,ST,MP) (T,ST,MPL) (T,ST,MRH)C
      (T,ST,MC) (T,SH,MH) (T,ST,MH)
      SET R2,ARRAY DATA, BEFORE ROW R15
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      IF((T,CL,MP).EQ.1.59), GO TO CK1
      (COLL,LJAS,FLPO)=(T,CL,MP)
              (COLL,(DATA,*1,LR),(DATA,*1,LP))=(T,CL,MP)
CK1   IF((T,CM,MP).EQ.1.39), GO TO CK2
              (COLL,(DATA,*1,FTR),(DATA,*1,LP))=(T,CM,MP)
CK2   IF((VC,CORN,MPFRM) .EQ.2.96), GO TO CK3
      (COLL,FRM,FLPO)=(VC,CORN,MPFRM)
      (COLL,FRM,(DATA,*1,LP))=(VC,CORN,MPFRM)
CK3   IF((VC,CORN,MFER).EQ.18.00), GO TO  CK33
      (COLL,FER,FLPO)=(VC,CORN,MFER)
      (COLL,FER,(DATA,*1,LP))=(VC,CORN,MFER)
CK33  IF((VC,CORN,MCP).EQ.0.0), GO TO CK32
      (COLL,CCH,FLPO)=(VC,CORN,MCP)
      (COLL,CCH,(DATA,*1,LP))=(VC,CORN,MCP)
CK32  IF((INFO,PRCNTR,PER).EQ.5.0), GO TO CK4
      (COLL,PSPLP,SLP1)=(INFO,PRCNTR,PER)
      (COLL,M,SLP1)=(-.15)* (INFO,PRCNTR,PER)
      (COLL,PSPLP,SLP2)=(INFO,PRCNTR,PER)
      (COLL,M,SLP2)=(-.15)* (INFO,PRCNTR,PER)
      (COLL,PSPLP,SLP3)=(INFO,PRCNTR,PER)
      (COLL,M,SLP3)=(-.15)* (INFO,PRCNTR,PER)
      (COLL,PSPLP,SLP4)=(INFO,PRCNTR,PER)
      (COLL,M,SLP4)=(-.15)* (INFO,PRCNTR,PER)
      (COLL,PSPLP,SLP5)=(INFO,PRCNTR,PER)
      (COLL,M,SLP5)=(-.15)* (INFO,PRCNTR,PER)
      (COLL,PSPLP,SLP6)=(INFO,PRCNTR,PER)
      (COLL,M,SLP6)=(-.15)* (INFO,PRCNTR,PER)
CK4   IF((T,CT,MP).EQ.1.39) , GO TO CK5
              (COLL,(DATA,*1,TFTR),(DATA,*1,LP))=(T,CT,MP)
CK5   SET R1,ARRAY DATA, AFTER  ROW R09
      IF((T,CL,MPL).EQ..69), GO TO CK6
              (COLS,(DATA,*1,LR),(DATA,*1,P))=(T,CL,MPL)
CK6   IF((T,CM,MPL).EQ.0.57), GO TO CK7
              (COLS,(DATA,*1,FTR),(DATA,*1,P))=(T,CM,MPL)
CK7   IF((VC,CORN,MHI).EQ.6.00), GOTO CK8
      (COLS,HI,(DATA,*1,P))=(VC,CORN,MHI)
CK8   IF((VC,CORN,MPLFRM).EQ.2.15) , GO TO CK9
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      (COLS,FRM,(DATA,*1,P))=(VC,CORN,MPLFRM)
CK9   IF((VC,CORN,MS).EQ.5.00), GO TO CK34
      (COLS,S,(DATA,*1,P))=(VC,CORN,MS)
CK34  IF((VC,CORN,MCPL).EQ.0.0) , GO TO CK10
      (COLS,CCH,(DATA,*1,P))=(VC,CORN,MCPL)
CK10  IF((T,CT,MPL).EQ.0.57) , GO TO CK11
      (COLS,(DATA,*1,TFTR),(DATA,*1,P))=(T,CT,MPL)
CK11  IF((T,CM,MRH).NE.0.16), GO TO CK44
      IF((T,CM,MC).EQ.0.30), GO TO CK45
CK44  (COLS,FM2,P1)=.5 * (T,CM,MRH)
      (COLS,FM3,P1)=.5 * (T,CM,MRH)
      (COLS,FMJ,P1)=0.5 * (T,CM,MC)
      (COLS,FM2,P2)=0.25 * (T,CM,MRH)
      (COLS,FM3,P2)=.5 * (T,CM,MRH)
      (COLS,FMJ,P2)=0.25 * (T,CM,MRH) + 0.25 * (T,CM,MC)
      (COLS,FM3,P3)=0.25 * (T,CM,MRH)
      (COLS,FMJ,P3)=0.75 * (T,CM,MRH)
      (COLS,FMJ,P4)=0.5 * (T,CM,MRH)
CK45  IF((T,CL,MRH).NE.0.17), GOTO CK46
      IF((T,CL,MC).EQ.0.33), GO TO CK47
CK46  (COLS,LM2,P1)=0.5 * (T,CL,MRH)
      (COLS,LM3,P1)=0.5 * (T,CL,MRH)
      (COLS,LMJ,P1)=0.5 * (T,CL,MC)
      (COLS,LJ2,P1)=0.5 * (T,CL,MC)
      (COLS,LM2,P2)=0.25 * (T,CL,MRH)
      (COLS,LM3,P2)=0.5 * (T,CL,MRH)
      (COLS,LMJ,P2)=0.25 * (T,CL,MRH) + 0.25 * (T,CL,MC)
      (COLS,LJ2,P2)=0.5 * (T,CL,MC)
      (COLS,LJAS,P2) =0.25 * (T,CL,MC)
      (COLS,LM3,P3)=0.25 * (T,CL,MRH)
      (COLS,LMJ,P3)=0.75 * (T,CL,MRH)
      (COLS,LJ2,P3)=0.5 * (T,CL,MC)
      (COLS,LJAS,P3) =0.5 * (T,CL,MC)
      (COLS,LMJ,P4)=0.5 * (T,CL,MRH)
      (COLS,LJ2,P4)=0.5 * (T,CL,MRH) + 0.5 * (T,CL,MC)
      (COLS,LJAS,P4) =0.5 * (T,CL,MC)
      (COLS,LJ2,P5)=(T,CL,MRH)
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      (COLS,LJAS,P5) =(T,CL,MC)
CK47  IF((T,CT,MRH).NE.0.16), GO TO CK48
      IF((T,CT,MC).EQ.0.30), GO TO CK49
CK48  (COLS,TFM2,P1)=0.5 * (T,CT,MRH)
      (COLS,TFM3,P1)=0.5 * (T,CT,MRH)
      (COLS,TFMJ,P1)=0.5 * (T,CT,MC)
      (COLS,TFM2,P2)=0.25 * (T,CT,MRH)
      (COLS,TFM3,P2)=0.5 * (T,CT,MRH)
      (COLS,TFMJ,P2)=0.25 * (T,CT,MRH) + 0.25 * (T,CT,MC)
      (COLS,TFM3,P3)=0.25 * (T,CT,MRH)
      (COLS,TFMJ,P3)=0.25 *(T,CT,MRH)
      (COLS,TFMJ,P4)=0.5 * (T,CT,MRH)
CK49  SET R1,ARRAY DATA, BEFORE ROW R01
      SET R2,ARRAY DATA, AFTER  ROW R35
      IF((T,CL,MH).EQ.1.38), GO TO CK12
      (COLCH,(DATA,*1,HL),(DATA,*1,CH))=(T,CL,MH)
CK12  IF((T,CM,MH).EQ.1.28), GO TO CK13
      (COLCH,(DATA,*1,HF),(DATA,*1,CH))=(T,CM,MH)
CK13  IF((VC,CORN,MHFRM).EQ.3.04), GO TO CK35
      (COLCH,FRM,(DATA,*1,CH))=(VC,CORN,MHFRM)
CK35  IF((VC,CORN,MCH).EQ.0.0) , GO TO CK14
      (COLCH,CCH,(DATA,*1,CH))=(VC,CORN,MCH)
CK14  IF((T,CT,MH).EQ.0.68), GO TO CH15
      (COLCH,(DATA,*1,HTF),(DATA,*1,CH))=(T,CT,MH)
CH15  IF((T,CH,MH).EQ.0.68), GO TO CH51
      (COLCH,(DATA,*1,HHF),(DATA,*1,CH))=(T,CH,MH)
CH51  IF((YIELD,CORN,MGR).EQ.130.0), GO TO CK15
      (COLCH,CGT,(DATA,*1,CH))=-1.0* (YIELD,CORN,MGR)
      (COLG,FL,FL)=-100./(YIELD,CORN,MGR)
      (COLG,PSPLP,PSPLP)=-100./(YIELD,CORN,MGR)
      (COLG,M,CD)=-1./(YIELD,CORN,MGR)
      (COLG,M,CS)=-15./(YIELD,CORN,MGR)
CK15  (COLC,C,CI)=-1.0*(VC,CORN,MI)
      SET R2,ARRAY DATA,BEFORE ROW R16
      IF((T,SL,MP).EQ.0.95), GO TO CK16
      (COLT,LJAS,SFLPO)=(T,SL,MP)
      (COLT,(DATA,*1,LR),(DATA,*1,SLP))=(T,SL,MP)
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CK16 SET R2,ARRAY DATA,BEFORE ROW R15
     IF((T,SM,MP).EQ.0.83), GO TO CK17
     (COLT,(DATA,*1,FTR),(DATA,*1,SLP))=(T,SM,MP)
CK17 SET R2,ARRAY DATA, AFTER ROW R15
     IF((VC,SB,MPFRM).EQ.1.75), GO TO CK18
     (COLT,SFRM,SFLPO)=(VC,SB,MPFRM)
     (COLT,SFRM,(DATA,*1,SLP))=(VC,SB,MPFRM)
CK18 IF((VC,SB,MFER).EQ.5.40), GO TO CK36
     (COLT,SFER,SFLPO)=(VC,SB,MFER)
     (COLT,SFER,(DATA,*1,SLP))=(VC,SB,MFER)
CK36 IF((VC,SB,MCP).EQ.0.0), GO TO CK19
     (COLT,SCH,SFLPO)=(VC,SB,MCP)
     (COLT,SCH,(DATA,*1,SLP))=(VC,SB,MCP)
CK19 SET R2,ARRAY DATA, BEFORE ROW R15
     IF((T,ST,MP).EQ.0.86), GO TO CK20
     (COLT,(DATA,*1,TFTR),(DATA,*1,SLP))=(T,ST,MP)
CK20 SET R2,ARRAY DATA, AFTER ROW R15
     SET R1,ARRAY DATA, AFTER  ROW R10
     IF((T,SL,MPL).EQ.0.69), GO TO CK21
     (COLS,(DATA,*1,LR),(DATA,*1,SP))=(T,SL,MPL)
CK21 IF((VC,SB,MPLFRM).EQ.2.50), GO TO CK22
     (COLS,SFRM,(DATA,*1,SP))=(VC,SB,MPLFRM)
CK22 IF((T,SM,MPL).EQ.0.56), GO TO CK52
CK52 (COLS,FM1,SP1)=(T,SM,MPL)
     (COLS,FM2,SP2)=(T,SM,MPL)
     (COLS,FM3,SP3)=(T,SM,MPL)
     (COLS,FMJ,SP4)=(T,SM,MPL)
CK23 IF((VC,SB,MHI).EQ.4.00), GO TO CK24
     (COLS,SH,(DATA,*1,SP))=(VC,SB,MHI)
CK24 IF((VC,SB,MS).EQ.4.00), GO TO CK37
     (COLS,SS,(DATA,*1,SP))=(VC,SB,MS)
CK37 IF((VC,SB,MCPL).EQ.0.0), GO TO CK25
     (COLS,SCH,(DATA,*1,SP))=(VC,SB,MCPL)
CK25 SET R2,ARRAY DATA, BEFORE ROW R15
     IF((T,ST,MPL).EQ.0.56), GO TO CK26
     (COLS,(DATA,*1,TFTR),(DATA,*1,SP))=(T,ST,MPL)
CK26 IF((T,SM,MRH).NE.0.22), GO TO CK50
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     IF((T,SM,MC).EQ.0.33), GO TO CK56
CK50 (COLS,FM2,SP1)=0.25 * (T,SM,MRH)
     (COLS,FM3,SP1)=0.5 * (T,SM,MRH)
     (COLS,FMJ,SP1)=0.25 * (T,SM,MRH)
     (COLS, FM3,SP2)=0.25 * (T,SM,MRH)
     (COLS, FMJ,SP2)=0.25 * (T,SM,MRH)
     (COLS, FMJ,SP3)=0.33 * (T,SM,MRH)
CK56 IF((T,SL,MRH).NE.0.20), GO TO CK57
     IF((T,SL,MC).EQ.0.30), GO TO CK53
CK57 (COLS,LM2,SP1)=0.25 * (T,SL,MRH)
     (COLS,LM3,SP1)=0.5 * (T,SL,MRH)
     (COLS,LMJ,SP1)=0.25 * (T,SL,MRH)
     (COLS,LJ2,SP1)=0.5 * (T,SL,MC)
     (COLS,LJAS,SP1)=0.5 * (T,SL,MC)
     (COLS,LM3,SP2)=0.25 * (T,SL,MRH)
     (COLS,LMJ,SP2)=0.5 * (T,SL,MRH)
     (COLS,LJ2,SP2)=0.25 * (T,SL,MRH) + 0.5 * (T,SL,MC)
     (COLS,LJAS,SP2)=0.5 * (T,SL,MC)
     (COLS,LMJ,SP3)=0.33 * (T,SL,MRH)
     (COLS,LJ2,SP3)=0.67 * (T,SL,MRH) + 0.33 * (T,SL,MC)
     (COLS,LJAS,SP3)=0.67 * (T,SL,MC)
     (COLS,LJ2,SP4)=0.5 * (T,SL,MRH)
     (COLS,LJAS,SP4)=0.5 * (T,SL,MRH) + (T,SL,MC)
     (COLS,LJAS,SP5)=(T,SL,MRH)+(T,SL,MC)
CK53 IF((T,ST,MRH).NE.0.22), GO TO CK54
     IF((T,ST,MC).EQ..30), GO TO CK55
CK54 (COLS,TFM2,SP1)=0.25 * (T,ST,MRH)
     (COLS,TFM3,SP1)=0.5 * (T,ST,MRH)
     (COLS,TFMJ,SP1)=0.25 * (T,ST,MRH)
     (COLS,TFM3,SP2)=0.25 * (T,ST,MRH)
     (COLS,TFMJ,SP2)=0.5 * (T,ST,MRH)
     (COLS,TFMJ,SP3)=0.33 * (T,ST,MRH)
CK55 SET R1, ARRAY DATA,BEFORE ROW R01
     SET R2, ARRAY DATA, AFTER ROW R16
     IF((T,SL,MH).EQ.0.99), GO TO CK27
     (COLSH,(DATA,*1,SHL),(DATA,*1,SBH))=(T,SL,MH)
CK27 IF((T,SM,MH).EQ.1.06), GO TO  CK28
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      (COLSH,(DATA,*1,SHM),(DATA,*1,SBH))=(T,SM,MH)
CK28  IF((VC,SB,MHFRM).EQ.1.28), GO TO CK38
      (COLSH,SFRM,(DATA,*1,SBH))=(VC,SB,MHFRM)
CK38  IF((VC,SB,MCH).EQ.0.0), GO TO CK29
      (COLSH,SCH,(DATA,*1,SBH))=(VC,SB,MCH)
CK29  IF((T,ST,MH).EQ.0.53), GO TO  CK40
      (COLSH,(DATA,*1,SHT),(DATA,*1,SBH))=(T,ST,MH)
CK40  IF((T,SH,MH).EQ.0.53), GO TO CH30
      (COLSH,(DATA,*1,SHH),(DATA,*1,SBH))=(T,SH,MH)
CH30  IF((YIELD,SB,MGR).EQ.40.0), GO TO CK30
      (COLSH,SB6,(DATA,*1,SBH))=-1.0 * (YIELD,SB,MGR)
      (COLG,PLPLH,SFL)=-100.0/(YIELD,SB,MGR)
CK30  (COLC,C,SBI)=-1.0*(VC,SB,MI)
      READ,FORMAT FMT4,CARDCNT=1, DATA (COLO,OFRM,OP) (COLO,OFER,OP)    C
      (COLO,OSEED,OP) (COLO,OMHIRE,OP) (COLO,OHHELP,OP) (COLC,C,OIA)
      WRITE, FORMAT FMT4,          DATA (COLO,OFRM,OP) (COLO,OFER,OP)    C
      (COLO,OSEED,OP) (COLO,OMHIRE,OP) (COLO,OHHELP,OP) (COLC,C,OIA)
      (COLC,C,OIA)=-1.0 * (COLC,C,OIA)
      READ, FORMAT FMT4,CARDCNT=1,DATA (COLO,LA1,OP) (COLO,LJAS,OP)      C
      (COLO,FA1,OP) (COLO,TFA1,OP)
      WRITE, FORMAT FMT4,          DATA (COLO,LA1,OP) (COLO,LJAS,OP)     C
      (COLO,FA1,OP) (COLO,TFA1,OP)
      (COLO,OGR,OP)= -1.0 * (YIELD,O,MGR)
      (COLO,OSTR,OP)= -1.0 * (YIELD,STR,MGR)
      READ,FORMAT FMT4, CARDCNT=1,DATA (INFO,NYIM,PER) (COLH,HFRM,MP)  C
      (COLH,HFER,MP) (COLH,HSEED,MP) (COLH,HMHIRE,MP) (COLH,HHHELP,MP) C
      (COLC,C,HIA)
      WRITE , FORMAT FMT4,         DATA (INFO,NYIM,PER) (COLH,HFRM,MP)  C
      (COLH,HFER,MP) (COLH,HSEED,MP) (COLH,HMHIRE,MP) (COLH,HHHELP,MP) C
      (COLC,C,HIA)
      (COLC,C,HIA)= -1.0 * (COLC,C,HIA)
      READ,FORMAT FMT4,CARDCNT=1,DATA (COLH,LA1,MP)(T2,HL2,MH) (T2,HL, C
      MH) (COLH,FA1,MP) (T2,HM,MH) (COLH,TFA1,MP) (T2,HT,MH)
      WRITE, FORMAT FMT4,         DATA (COLH,LA1,MP)(T2,HL2,MH) (T2,HL, C
      MH) (COLH,FA1,MP) (T2,HM,MH) (COLH,TFA1,MP) (T2,HT,MH)
      (COLH,LMJ,MP) = .2 * (T2,HL,MH)
      (COLH,LJ2,MP) = .2 * (T2,HL,MH)
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      (COLH,LJAS,MP)= .6 * (T2,HL,MH) + (T2,HL2,MH)
      (COLH,FMJ,MP)= .2* (T2,HM,MH)
      (COLH,TFMJ,MP)=.2* (T2,HT,MH)
      (COLH,HAY,MP)=-1.0 * (YIELD,HAY,MGR)
      IF((INFO,NYIM,PER).EQ.2.0), GO TO CK60
      (COLD,LTM,DI20)=-1.0 * (INFO,NYIM,PER)
      (COLO,LTM,OP)   =-1.0 * (INFO,NYIM,PER)
CK60  (REVIZE ,STU,XDATA)=PROB1
      FILE REVIZE,ON ECON2, AS REVISE , AT POSITION, COMMUNICATION FORM
      FORMAT FMT2, DATA (F1,W10,D2) 6(W10,D2) (/)(F1,W10,D2) 6(W10,D2) C
      (/) (F1,W10,D2) 6(W10,D2)
      FORMAT FMT3, DATA (F1,W10) 3(W10,D2) (W10)
      READ, FORMAT FMT3,CARDCNT=1, DATA (INFO,PAR,DI) (INFO,DET,PER)    C
      (COLD,C,DI20) (RHS,CONB,B) (INFO,PRCNTR,DI)
      WRITE,FORMAT FMT3,          DATA (INFO,PAR,DI) (INFO,DET,PER)    C
      (COLD,C,DI20) (RHS,CONB,B) (INFO,PRCNTR,DI)
      IF((INFO,PAR,DI).EQ.'NO'), GO TO CH6
      (RHS,DA20,B)=.20*(INFO,DET,PER)
      READ, FORMAT FMT4,CARDCNT=1,DATA (COLD,DFRM,DI20)                C
      (COLD,DSEED,DI20)                         (COLD,LA1,DI20)        C
      (COLD,LJAS,DI20) (COLD,FA1,DI20) (COLD,TFA1,DI20)
      WRITE,FORMAT FMT4,          DATA (COLD,DFRM,DI20)                C
      (COLD,DSEED,DI20)                         (COLD,LA1,DI20)        C
      (COLD,LJAS,DI20) (COLD,FA1,DI20) (COLD,TFA1,DI20)
      GO TO CK61
CH6   (RHS,DA20,B)=0.000001
      (RHS,CONB,B)=0.000001
CK61  (SECTION,STU,XDATA)=COLUMNS
      FILE SECTION,ON ECON2, COMMUNICATION FORM
      (SECTION,STU,XDATA)=MODIFY
      FILE SECTION, ON ECON2,COMMUNICATION FORM
      FILE COLL,ON ECON2, COMMUNICATION FORM
      FILE COLS,ON ECON2, COMMUNICATION FORM
      FILE COLCH, ON ECON2,COMMUNICATION FORM
      FILE COLC,ON ECON2, COMMUNICATION FORM
      FILE COLG,ON ECON2, COMMUNICATION FORM
      FILE COLT,ON ECON2, COMMUNICATION FORM
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FILE COLSH, ON ECON2,COMMUNICATION FORM
FILE COLD,ON ECON2, COMMUNICATION FORM
FILE COLRNT,ON ECON2,COMMUNICATION FORM
FILE COLO,ON ECON2, COMMUNICATION FORM
FILE COLH,ON ECON2, COMMUNICATION FORM
(SECTION,STU,XDATA)=RHS
FILE SECTION,ON ECON2, COMMUNICATION FORM
(SECTION,STU,XDATA)=MODIFY
FILE SECTION,ON ECON2, COMMUNICATION FORM
READ,FORMAT FMT2,CARDCNT=3, DATA (INFO,HIRE,PER)              (RHS,C
LA1R,B) (RHS,LA2R,B) (RHS,LM1R,B)(RHS,LM2R,B) (RHS,LM3R,B)  (RHS,C
LMJR,B) (RHS,LJ2R,B) (RHS,LJASR,B)(RHS,LSOR,B)              (RHS,C
LO2R,B) (RHS,LO3R,B) (RHS,LONR,B)(RHS,LN2R,B) (RHS,LN3R,B)  (RHS,C
LNDR,B) (RHS,LD2R,B)
WRITE, FORMAT FMT2,         DATA (INFO,HIRE,PER)              (RHS,C
LA1R,B) (RHS,LA2R,B) (RHS,LM1R,B)(RHS,LM2R,B) (RHS,LM3R,B)  (RHS,C
LMJR,B) (RHS,LJ2R,B) (RHS,LJASR,B)(RHS,LSOR,B)              (RHS,C
LO2R,B) (RHS,LO3R,B) (RHS,LONR,B)(RHS,LN2R,B) (RHS,LN3R,B)  (RHS,C
LNDR,B) (RHS,LD2R,B)
READ, FORMAT FMT2, CARDCNT=2, DATA(RHS,FA1,B)  (RHS,FA2,B) (RHS, C
FM1,B) (RHS,FM2,B) (RHS,FM3,B) (RHS,FMJ,B) (RHS,FSO,B) (RHS,FO2,BC
) (RHS,FO3,B) (RHS,FON,B) (RHS,FN2,B) (RHS,FN3,B) (RHS,FND,B)    C
(RHS,FD2,B)
WRITE,FORMAT FMT2,            DATA(RHS,FA1,B)  (RHS,FA2,B) (RHS, C
FM1,B) (RHS,FM2,B) (RHS,FM3,B) (RHS,FMJ,B) (RHS,FSO,B) (RHS,FO2,BC
) (RHS,FO3,B) (RHS,FON,B) (RHS,FN2,B) (RHS,FN3,B) (RHS,FND,B)    C
(RHS,FD2,B)
READ, FORMAT FMT2, CARDCNT=2,DATA (RHS,TFA1,B) (RHS,TFA2,B) (RHS,C
TFM1,B)  (RHS,TFM2,B) (RHS,TFM3,B) (RHS,TFMJ,B) (RHS,TFSO,B)(RHS,C
TFO2,B)  (RHS,TFO3,B) (RHS,TFON,B) (RHS,TFN2,B) (RHS,TFN3,B)(RHS,C
TFND,B)  (RHS,TFD2,B)
WRITE,FORMAT FMT2,            DATA (RHS,TFA1,B) (RHS,TFA2,B) (RHS,C
TFM1,B)  (RHS,TFM2,B) (RHS,TFM3,B) (RHS,TFMJ,B) (RHS,TFSO,B)(RHS,C
TFO2,B)  (RHS,TFO3,B) (RHS,TFON,B) (RHS,TFN2,B) (RHS,TFN3,B)(RHS,C
TFND,B)  (RHS,TFD2,B)
READ, FORMAT FMT2, CARDCNT=1, DATA (RHS,HFSO,B) (RHS,HFO2,B) (RHSC
,HFO3,B) (RHS,HFON,B) (RHS,HFN2,B) (RHS,HFN3,B) (RHS,HFND,B)
```

```
WRITE,FORMAT FMT2,             DATA (RHS,HFSO,B) (RHS,HFO2,B) (RHSC
,HFO3,B) (RHS,HFON,B) (RHS,HFN2,B) (RHS,HFN3,B) (RHS,HFND,B)
IF((INFO,HIRE,PER).EQ.7.0), GO TO CK58
(RHS,LA1R,B)=17.14* (RHS,LA1R,B)
(RHS,LA2R,B)=8.57 * (RHS,LA2R,B)
(RHS,LM1R,B)=8.57 * (RHS,LM1R,B)
(RHS,LM2R,B)=8.57 * (RHS,LM2R,B)
(RHS,LM3R,B)=8.57 * (RHS,LM3R,B)
(RHS,LMJR,B)=8.57 * (RHS,LMJR,B)
(RHS,LJ2R,B)=8.57 * (RHS,LJ2R,B)
(RHS,LJASR,B)=83.13 * (RHS,LJASR,B)
(RHS,LSOR,B)= 9.43 * (RHS,LSOR,B)
(RHS,LO2R,B)= 8.57 * (RHS,LO2R,B)
(RHS,LO3R,B)= 8.57 * (RHS,LO3R,B)
(RHS,LONR,B)= 8.57 * (RHS,LONR,B)
(RHS,LN2R,B)= 8.57 * (RHS,LN2R,B)
(RHS,LN3R,B)= 8.57 * (RHS,LN3R,B)
(RHS,LNDR,B)= 8.57 * (RHS,LNDR,B)
(RHS,LD2R,B)= 9.43 * (RHS,LD2R,B)
(RHS,FA1,B)= 9.700 * (RHS,FA1,B)
(RHS,FA2,B)=5.86 * (RHS,FA2,B)
(RHS,FM1,B)=5.32 * (RHS,FM1,B)
(RHS,FM2,B)=5.83 * (RHS,FM2,B)
(RHS,FM3,B)=6.01 * (RHS,FM3,B)
(RHS,FMJ,B)=5.50 * (RHS,FMJ,B)
(RHS,FSO,B)=7.13 * (RHS,FSO,B)
(RHS,FO2,B)=6.55 * (RHS,FO2,B)
(RHS,FO3,B)=6.68 * (RHS,FO3,B)
(RHS,FON,B)=6.90 * (RHS,FON,B)
(RHS,FN2,B)=6.34 * (RHS,FN2,B)
(RHS,FN3,B)=5.87 * (RHS,FN3,B)
(RHS,FND,B)=3.69 * (RHS,FND,B)
(RHS,FD2,B)=1.46 * (RHS,FD2,B)
(RHS,TFA1,B)=9.700 * (RHS,TFA1,B)
(RHS,TFA2,B)=5.86  * (RHS,TFA2,B)
(RHS,TFM1,B)=5.32  * (RHS,TFM1,B)
(RHS,TFM2,B)=5.83  * (RHS,TFM2,B)
```

```
      (RHS,TFM3,B)=6.01   * (RHS,TFM3,B)
      (RHS,TFMJ,B)=5.50   * (RHS,TFMJ,B)
      (RHS,TFSO,B)=7.13   * (RHS,TFSO,B)
      (RHS,TFO2,B)=6.55   * (RHS,TFO2,B)
      (RHS,TFO3,B)=6.68   * (RHS,TFO3,B)
      (RHS,TFON,B)=6.90   * (RHS,TFON,B)
      (RHS,TFN2,B)=6.34   * (RHS,TFN2,B)
      (RHS,TFN3,B)=5.87   * (RHS,TFN3,B)
      (RHS,TFND,B)=3.69   * (RHS,TFND,B)
      (RHS,TFD2,B)=1.46   * (RHS,TFD2,B)
      (RHS,HFSO,B)=7.13   * (RHS,HFSO,B)
      (RHS,HFO2,B)=6.55   * (RHS,HFO2,B)
      (RHS,HFO3,B)=6.68   * (RHS,HFO3,B)
      (RHS,HFON,B)=6.90   * (RHS,HFON,B)
      (RHS,HFN2,B)=6.34   * (RHS,HFN2,B)
      (RHS,HFN3,B)=5.87   * (RHS,HFN3,B)
      (RHS,HFND,B)=3.69   * (RHS,HFND,B)
      GO TO CK59
CK58  (RHS,LA1R,B)=20.00* (RHS,LA1R,B)
      (RHS,LA2R,B)=10.0 * (RHS,LA2R,B)
      (RHS,LM1R,B)=10.0 * (RHS,LM1R,B)
      (RHS,LM2R,B)=10.0 * (RHS,LM2R,B)
      (RHS,LM3R,B)=10.0 * (RHS,LM3R,B)
      (RHS,LMJR,B)=10.0 * (RHS,LMJR,B)
      (RHS,LJ2R,B)=10.0 * (RHS,LJ2R,B)
      (RHS,LJASR,B)=97.00 * (RHS,LJASR,B)
      (RHS,LSOR,B)= 11.0 * (RHS,LSOR,B)
      (RHS,LO2R,B)= 10.0 * (RHS,LO2R,B)
      (RHS,LO3R,B)= 10.0 * (RHS,LO3R,B)
      (RHS,LONR,B)= 10.0 * (RHS,LONR,B)
      (RHS,LN2R,B)= 10.0 * (RHS,LN2R,B)
      (RHS,LN3R,B)= 10.0 * (RHS,LN3R,B)
      (RHS,LNDR,B)= 10.0 * (RHS,LNDR,B)
      (RHS,LD2R,B)= 11.0 * (RHS,LD2R,B)
      (RHS,FA1,B)= 11.32 * (RHS,FA1,B)
      (RHS,FA2,B)=6.84 * (RHS,FA2,B)
      (RHS,FM1,B)=6.21 * (RHS,FM1,B)
```

```
      (RHS,FM2,B)=6.80 * (RHS,FM2,B)
      (RHS,FM3,B)=7.01 * (RHS,FM3,B)
      (RHS,FMJ,B)=6.42 * (RHS,FMJ,B)
      (RHS,FSO,B)=8.32 * (RHS,FSO,B)
      (RHS,FO2,B)=7.64 * (RHS,FO2,B)
      (RHS,FO3,B)=7.79 * (RHS,FO3,B)
      (RHS,FON,B)=8.05 * (RHS,FON,B)
      (RHS,FN2,B)=7.40 * (RHS,FN2,B)
      (RHS,FN3,B)=6.85 * (RHS,FN3,B)
      (RHS,FND,B)=4.31 * (RHS,FND,B)
      (RHS,FD2,B)=1.70 * (RHS,FD2,B)
      (RHS,TFA1,B)=11.32 * (RHS,TFA1,B)
      (RHS,TFA2,B)=6.84  * (RHS,TFA2,B)
      (RHS,TFM1,B)=6.21  * (RHS,TFM1,B)
      (RHS,TFM2,B)=6.80  * (RHS,TFM2,B)
      (RHS,TFM3,B)=7.01  * (RHS,TFM3,B)
      (RHS,TFMJ,B)=6.42  * (RHS,TFMJ,B)
      (RHS,TFSO,B)=8.32  * (RHS,TFSO,B)
      (RHS,TFO2,B)=7.64  * (RHS,TFO2,B)
      (RHS,TFO3,B)=7.79  * (RHS,TFO3,B)
      (RHS,TFON,B)=8.05  * (RHS,TFON,B)
      (RHS,TFN2,B)=7.40  * (RHS,TFN2,B)
      (RHS,TFN3,B)=6.85  * (RHS,TFN3,B)
      (RHS,TFND,B)=4.31  * (RHS,TFND,B)
      (RHS,TFD2,B)=1.70  * (RHS,TFD2,B)
      (RHS,HFSO,B)=8.32  * (RHS,HFSO,B)
      (RHS,HFO2,B)=7.64  * (RHS,HFO2,B)
      (RHS,HFO3,B)=7.79  * (RHS,HFO3,B)
      (RHS,HFON,B)=8.05  * (RHS,HFON,B)
      (RHS,HFN2,B)=7.40  * (RHS,HFN2,B)
      (RHS,HFN3,B)=6.85  * (RHS,HFN3,B)
      (RHS,HFND,B)=4.31  * (RHS,HFND,B)
CK59  ($COMMUN,R1,C1)=0.0
      IF((INFO,PAR,DI).EQ.'NO'), GO TO CK39
      IF((INFO,PRCNTR,DI).NE.'YES'), GO TO CK39
      (RHS,*1,B2)=(RHS,*1,B)
      (RHS,DA20,B2)=0.0
```

```
      (RHS,CONB,B2)=0.0
      ($COMMUN,R1,C1)=1.0
CK39  FILE RHS, ON ECON2, COMMUNICATION FORM
      (SECTION,STU,XDATA)=ENDATA
      FILE SECTION, ON ECON2,COMMUNICATION FORM
      RETURN
      PEND
```

*DATA	CH	SBH	LP	LR	FTR	TFTR	P	HL	HF	HTF	HHF	SLP
R01	CH101	SH101	FLP1	LSO	FSO	TFSO		LSO	FSO	TFSO	HFSO	SFLP1
R02	CH102	SH102	FLP2	LO2	FO2	TFO2		LO2	FO2	TFO2	HFO2	SFLP2
R03	CH103	SH103	FLP3	LO3	FO3	TFO3		LO3	FO3	TFO3	HFO3	SFLP3
R04	CH104	SH104	FLP4	LON	FON	TFON		LON	FON	TFON	HFON	SFLP4
R05	CH105	SH201	FLP5	LN2	FN2	TFN2		LN2	FN2	TFN2	HFN2	SFLP5
R06	CH106	SH202	FLP6	LN3	FN3	TFN3		LN3	FN3	TFN3	HFN3	SFLP6
R07	CH107	SH203	FLP7	LND	FND	TFND		LND	FND	TFND	HFND	SFLP7
R08	CH201	SH204	FLP8	LD2	FD2	TFD2		LSO	FSO	TFSO	HFSO	SFLP8
R09	CH202	SH302	SLP1	LA1	FA1	TFA1		LO2	FO2	TFO2	HFO2	SSLP1
R10	CH203	SH303	SLP2	LA2	FA2	TFA2	P1	LO3	FO3	TFO3	HFO3	SSLP2
R11	CH204	SH304	SLP3	LM1	FM1	TFM1	P2	LON	FON	TFON	HFON	SSLP3
R12	CH205	SH402	SLP4	LM2	FM2	TFM2	P3	LN2	FN2	TFN2	HFN2	SSLP4
R13	CH206	SH403	SLP5	LM3	FM3	TFM3	P4	LN3	FN3	TFN3	HFN3	SSLP5
R14	CH207	SH404	SLP6	LMJ	FMJ	TFMJ	P5	LND	FND	TFND	HFND	SSLP6
R15	CH301	SH503		LJ2				LSO	FSO	TFSO	HFSO	SSLP7
R16	CH302	SH504						LO2	FO2	TFO2	HFO2	
R17	CH303							LO3	FO3	TFO3	HFO3	
R18	CH304							LON	FON	TFON	HFON	
R19	CH305							LN2	FN2	TFN2	HFN2	
R20	CH306							LN3	FN3	TFN3	HFN3	
R21	CH307							LND	FND	TFND	HFND	
R22	CH401							LSO	FSO	TFSO	HFSO	
R23	CH402							LO2	FO2	TFO2	HFO2	
R24	CH403							LO3	FO3	TFO3	HFO3	
R25	CH404							LON	FON	TFON	HFON	
R26	CH405							LN2	FN2	TFN2	HFN2	
R27	CH406							LN3	FN3	TFN3	HFN3	
R28	CH407							LND	FND	TFND	HFND	
R29	CH501							LSO	FSO	TFSO	HFSO	
R30	CH502							LO2	FO2	TFO2	HFO2	
R31	CH503							LO3	FO3	TFO3	HFO3	
R32	CH504							LON	FON	TFON	HFON	
R33	CH505							LN2	FN2	TFN2	HFN2	
R34	CH506							LN3	FN3	TFN3	HFN3	
R35	CH507							LND	FND	TFND	HFND	

* SP SHL SHM SHT SHH

```
R01         L02   F02   TF02   HF02
R02         L03   F03   TF03   HF03
R03         LON   FON   TFON   HFON
R04         LN2   FN2   TFN2   HFN2
R05         L02   F02   TF02   HF02
R06         L03   F03   TF03   HF03
R07         LON   FON   TFON   HFON
R08         LN2   FN2   TFN2   HFN2
R09         L03   F03   TF03   HF03
R10         LON   FON   TFON   HFON
R11   SP1   LN2   FN2   TFN2   HFN2
R12   SP2   L03   F03   TF03   HF03
R13   SP3   LON   FON   TFON   HFON
R14   SP4   LN2   FN2   TFN2   HFN2
R15   SP5   LON   FON   TFON   HFON
R16         LN2   FN2   TFN2   HFN2
++ENDATA
```

APPENDIX C: REPORT GENERATOR SOURCE PROGRAM FOR REPORTING THE SOLUTIONS

```
NAME           PROB1
 D A,DMVC='MISC. VARIABLE COSTS' & A,DS='SEED' & A,DFER='FERTILIZER'
 D A,DSH='HERBICIDE' & A,DHI='HERBICIDE AND INSECTICIDE'
 D A,DLH10='JUNE 20 - SEPT. 24'
 D A,DCHIR='MACHINE HIRE'
 D A,DLH3='APR. 1-20'  & A,DLH4='APR. 21-30' & A,DLH5='MAY 1-10'
 D A,DLH6='MAY 11-20'  & A,DLH7='MAY 21-30' & A,DLH8='MAY 31 -JUNE 9'
 D A,DLH9='JUNE 10-19' & A,DLH12='SEPT. 25 - OCT. 5'
 D A,DLH13='OCT. 6-15' & A,DLH14='OCT. 16-25' & A,DLH16='NOV. 5-14'
 D A,DLH15='OCT. 26 - NOV. 4' & A,DLH17='NOV. 15-24'
 D A,DLH18='NOV. 25 - DEC. 4' & A,DLH19='DEC. 5-15'
 T-N,PAR=X,DI20 - E,1.0, REP
 H      THIS SECTION REPORTS THE OPTIMUM SOLUTION WITH 20.00% PARTICIPATI
 C ON IN THE SET-ASIDE PROGRAM
 T ,REP2
 L REP
 H      THIS SECTION REPORTS THE OPTIMUM SOLUTION WITH NO SET-ASIDE PROGR
 C AM PARTICIPATION
 L REP2
 M1
 H         *************************      ******.**
 I A1$$$$$$
 I X2$$$$$$
 M1
 H                        INCOME STATEMENT
 H   INCOME
 H         SOYBEAN SALES                *  ******.**
 I E,'$'
 I X,SSELL * C,SSELL
 H         CORN SALES                      ******.**
 I X,CS * C,CS
 H         SET-ASIDE PAYMENTS              ******.**
 I X,DI20 * C,DI20
 H         OAT SALES                       ******.**
 I N,OIN=X,OSELL * C,OSELL
 H         STRAW VALUE OR SALES            ******.**
 I N,STRIN=X,STRSELL *C,STRSELL
```

```
H          HAY VALUE OR SALES                  ******.**
I N,HIN=X,HSELL * C,HSELL
H          TOTAL GROSS INCOME                                     ******.**
I N,TGI= X,DI20 *C,DI20 + X,CS * C,CS + X,SSELL * C,SSELL
C  +N,OIN + N,STRIN + N,HIN
H    EXPENSES
H      SOYBEANS
H          FUEL, OIL, REPAIRS AND
E1 1,DMVC & 2,SFRM
E1 1,DFER & 2,SFER
E1 1,DSH & 2,SH
E1 1,DS   & 2,SS
E1 1,DCHIR & 2,SCHIR
H          INTEREST ON VARIABLE COSTS          ******.**
I  X,SBI * C,SBI * E,-1.0
H          SUBTOTAL                                      ******.**
I  N,SEXP= X,SFER + X,SH + X,SS +(X,SBI * C,SBI * E,-1.0) + X,SFRM
C  + X,SCHIR
H      CORN
H          FUEL, OIL, REPAIRS AND
E1 1,DMVC & 2,FRM
E1 1,DFER & 2,FER
E1 1,DHI & 2,HI
E1 1,DS  & 2,SEED
H          DRYING                              ******.**
I  X,CD * C,CD * E,-1.0
E1 1,DCHIR & 2,CCHIR
H          INTEREST ON VARIABLE COSTS          ******.**
I X,CI * C,CI  * E,-1.0
H          SUBTOTAL                                      ******.**
I N,CEXP= X,FER + X,HI + X,SEED +X,CD * C,CD * E,-1.0  + X,CI * C,CI *
C E,-1.0 + X,FRM + X,CCHIR
H      SET-ASIDE ACRES
H          FUEL, OIL, REPAIRS AND
E1 1,DMVC & 2,DIFRM
H          COVER CROP SEED COSTS               ******.**
I X,DISEED
```

```
E1 1,DCHIR & 2,DICHIR
H          SUBTOTAL                                      ******.**
I N,DIEXP=X,DIFRM + X,DISEED + X,DICHIR
H     OATS
H          FUEL, OIL, REPAIRS AND
E1 1,DMVC & 2,OFRMA
E1 1,DFER & 2,OFERA
E1 1,DS & 2,OSEEDA
E1 1,DCHIR & 2,OMHIREA
H          HOURLY HIRED LABOR COSTS        ******.**
I N,OEXPA=X,OHHELPA
H          INTEREST ON VARIABLE COSTS      ******.**
I N,OEXP=X,OIA * C,OIA  * E,-1.0
H          SUBTOTAL                                      ******.**
I N,OEXP=N,OEXP + X,OFRMA+X,OFERA + X,OSEEDA +  X,OMHIREA + X,OHHELPA
TH    HAY
H          FUEL, OIL, REPAIRS AND
E1 1,DMVC & 2,HFRMA
E1 1,DFER & 2,HFERA
E1 1,DS & 2,HSEEDA
E1 1,DCHIR & 2,HMHIREA
H          HOURLY HIRED LABOR COSTS        ******.**
I N,HEXPA=X,HHHELPA
H          INTEREST ON VARIABLE COSTS      ******.**
I N,HEXP=X,HIA * C,HIA  * E,-1.0
H          SUBTOTAL                                      ******.**
I N,HEXP=N,HEXP + X,HFRMA + X,HFERA + X,HSEEDA + X,HMHIREA + X,HHHELPA
3H         OTHER HIRED LABOR COSTS                       ******.**
I  N,THLC=X,TLHC * C,TLHC * E,-1.0
H          TOTAL VARIABLE COSTS                                    ******.**
I  N,TVC=N,SEXP + N,CEXP + N,DIEXP + N,OEXP + N,HEXP + N,THLC
H   RETURNS OVER VARIABLE COSTS                                    ******.**
I N,TGI - N,TVC
H          TOTAL FIXED MACHINERY COSTS                             ******.**
I  X,TFCM
H          TOTAL FIXED LABOR COSTS                                 ******.**
I  X,TFCL
```

```
 H          TOTAL FIXED LAND  COSTS                                    ******.**
 I X,TFCLND
 H          LAND RENTAL          ****.** ACRES                         ******.**
 I X,RNTLND
 I X,RNTLND * C,RNTLND * E,-1.0
 H   RETURNS TO MANAGEMENT
 C ******.**
 I N,TGI - N,TVC          - X,TFCM -X,TFCL -X,TFCLND +X,RNTLND *C,RNTLND
TH   SOYBEANS
 N N,TAP=X,SP1 + X,SP2 + X,SP3 + X,SP4 + X,SP5
 N N,TBH=X,SSELL
 N N,BPA=N,TBH / N,TAP
 H         TOTAL ACRES PLANTED         ******.**
 I N,TAP
 H         TOTAL BUSHELS HARVESTED     ******.**
 I N,TBH
 H         AVERAGE YIELD               ******.**
 I N,BPA
2H   CORN
 N N,TAP=X,P1 + X,P2 + X,P3 +X,P4 + X,P5
 N N,TBH=X,CS
 N N,BPA=N,TBH / N,TAP
 H         TOTAL ACRES PLANTED         ******.**
 I N,TAP
 H         TOTAL BUSHELS HARVESTED     ******.**
 I N,TBH
 H         AVERAGE YIELD               ******.**
 I N,BPA
2H   OATS AND STRAW
 N N,TAP=X,OP
 N N,TBH=X,OSELL
 N N,BPA=N,TBH / N,TAP
 H         TOTAL ACRES SEEDED          ******.**
 I N,TAP
 H         TOTAL BUSHELS HARVESTED     ******.**
 I N,TBH
 H         AVERAGE YIELD               ******.**
```

```
 I N,BPA
 N N,TBH=X,STRSELL
 N N,BPA=N,TBH / N,TAP
 H         TOTAL TONS STRAW HARVESTED ******.**
 I N,TBH
 H         AVERAGE YIELD (TONS)       ******.**
 I N,BPA
2H   HAY
 N N,TAP=X,MP
 N N,TBH=X,HSELL
 N N,BPA=N,TBH / N,TAP
 H         TOTAL ACRES IN MEADOW      ******.**
 I N,TAP
 H         TOTAL TONS HARVESTED       ******.**
 I N,TBH
 H         AVERAGE YIELD              ******.**
 I N,BPA
2H   SET-ASIDE ACRES
 H         TOTAL ACRES IN SET-ASIDE PROGRAM  ******.**
 I X,DI20
TH                     SCHEDULE OF FIELD OPERATIONS
2H        SET-ASIDE ACRES
 H         ACRES PREPARED AND SEEDED FROM APRIL 1-20    ****.**
 I X,DI20
2H        ACRES OF MEADOW PRODUCTION DURING APRIL 1-20  ****.**
 I X,MP
 H        HAY HARVEST OCURS DURING THE PERIODS-
 H        FIRST CUTTING, MAY 31 - JUNE 19
 H        SECOND AND THIRD CUTTINGS, JUNE 20 - SEPT. 24.
2H        ACRES OF OATS SEEDED FROM APRIL 1-20  ****.**
 I X,OP
 H        OATS HARVEST AND STRAW BALEING OCURS DURING THE PERIOD JUNE 20
 C - SEPT. 24.
3H        SOYBEANS
 H         PREPLANTING PERIOD FIELD PREPARATION (SPREAD P&K, DISK AND PLO
 C W)
2H                  ACRES PREPARED BY PERIODS
```

```
 H         FALL PERIODS                           ACRES
 M2
 H             ************************  ****.**
 I A1$$$$$$$$
 I X2$$$$$$$$
 M2
 E2 1,DLH10 & 2,SFLP0
 E2 1,DLH12 & 2,SFLP1
 E2 1,DLH13 & 2,SFLP2
 E2 1,DLH14 & 2,SFLP3
 E2 1,DLH15 & 2,SFLP4
 E2 1,DLH16 & 2,SFLP5
 E2 1,DLH17 & 2,SFLP6
 E2 1,DLH18 & 2,SFLP7
 E2 1,DLH19 & 2,SFLP8
 H         SPRING PERIODS                         ACRES
 E2 1,DLH3  & 2,SSLP1
 E2 1,DLH4  & 2,SSLP2
 E2 1,DLH5  & 2,SSLP3
 E2 1,DLH6  & 2,SSLP4
 E2 1,DLH7  & 2,SSLP5
 E2 1,DLH8  & 2,SSLP6
 E2 1,DLH9  & 2,SSLP7
2H         PLANTING SCHEDULE (FINAL FIELD PREPARATION AND PLANTING)
2H         PERIODS                                ACRES
 E2 1,DLH5  & 2,SP1
 E2 1,DLH6  & 2,SP2
 E2 1,DLH7  & 2,SP3
 E2 1,DLH8  & 2,SP4
 E2 1,DLH9  & 2,SP5
2H         HARVESTING SCHEDULE
2H         HARVEST DATES         /              PLANTING DATES
 H                                MAY 1-10         MAY 11-20        MAY 21
 C -30        MAY 31 - JUNE 9    JUNE 10-19
 M3
 H             ***************** ****.**          *****.**         *****
 C .**          *****.**          *****.**
```

```
 I A1$$$$$$$
 I X2$$$$$$$
 I X3$$$$$$$
 I X4$$$$$$$
 I X5$$$$$$$
 I X6$$$$$$$
 M3
 H             ***************** ****.**          *****.**          -----
 C ---           --------          --------
 I A,DLH13
 I X,SH101
 I X,SH201
 H             ***************** ****.**          *****.**          *****
 C .**           *****.**          --------
 I A,DLH14
 I X,SH102
 I X,SH202
 I X,SH302
 I X,SH402
 E3 1,DLH14 & 2,SH103 & 3,SH203 & 4,SH303 & 5,SH403 & 6,SH503
 E3 1,DLH15 & 2,SH104 & 3,SH204 & 4,SH304 & 5,SH404 & 6,SH504
TH        CORN
 H         PREPLANTING PERIOD FIELD PREPARATION (CHOP STALKS, SPREAD P&K,
 H           DISK, PLOW, AND APPLY NITROGEN)
2H                    ACRES PREPARED BY PERIODS
 H         FALL PERIODS                        ACRES
 E2 1,DLH10 & 2,FLP0
 E2 1,DLH12 & 2,FLP1
 E2 1,DLH13 & 2,FLP2
 E2 1,DLH14 & 2,FLP3
 E2 1,DLH15 & 2,FLP4
 E2 1,DLH16 &2,FLP5
 E2 1,DLH17 & 2,FLP6
 E2 1,DLH18 & 2,FLP7
 E2 1,DLH19 & 2,FLP8
 H         SPRING PERIODS                      ACRES
 E2 1,DLH3  & 2,SLP1
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```
 E2 1,DLH4  & 2,SLP2
 E2 1,DLH5  & 2,SLP3
 E2 1,DLH6  & 2,SLP4
 E2 1,DLH7  & 2,SLP5
 E2 1,DLH8  & 2,SLP6
2H        PLANTING SCHEDULE (FINAL FIELD PREPARATION AND PLANTING)
2H        PERIODS                                  ACRES
 E2 1,DLH4 & 2,P1
 E2 1,DLH5 & 2,P2
 E2 1,DLH6 & 2,P3
 E2 1,DLH7  & 2,P4
 E2 1,DLH8  & 2,P5
2H        HARVESTING SCHEDULE
2H        HARVEST DATES        /                         PLANTING DATES
 H                            APRIL 21-30        MAY 1-10         MAY
 C  11-20          MAY 21-30           MAY 31 - JUNE 9
 M3
 H            *******************   *****.**        *****.**          **
 C ****.**          *****.**              *****.**
 I A1$$$$$$$
 I X2$$$$$$$
 I X3$$$$$$$
 I X4$$$$$$$
 I X5$$$$$$$
 I X6$$$$$$$
 M3
 E3 1,DLH12 & 2,CH101 & 3,CH201 & 4,CH301 & 5,CH401 & 6,CH501
 E3 1,DLH13 & 2,CH102 & 3,CH202 & 4,CH302 & 5,CH402 & 6,CH502
 E3 1,DLH14 & 2,CH103 & 3,CH203 & 4,CH303 & 5,CH403 & 6,CH503
 E3 1,DLH15 & 2,CH104 & 3,CH204 & 4,CH304 & 5,CH404 & 6,CH504
 E3 1,DLH16 & 2,CH105 & 3,CH205 & 4,CH305 & 5,CH405 & 6,CH505
 E3 1,DLH17 & 2,CH106 & 3,CH206 & 4,CH306 & 5,CH406 & 6,CH506
 E3 1,DLH18 & 2,CH107 & 3,CH207 & 4,CH307 & 5,CH407 & 6,CH507
TH       RESOURCES USED, UNUSED AND THEIR VALUE
2H       RETURNS TO THE LAST ACRE OF LAND AVAILABLE IN THE FARM PLAN
 C   ****.**
 I P,L1 * E,-1.0
```

```
2H        TRACTOR HOURS AVAILABLE AND USED FOR "IN THE FIELD" OPERATIONS
2H        TIME                        TRACTOR    TRACTOR        INCOME CHANGE
 H        PERIODS                     HOURS      HOURS          FROM ONE
 H                                    USED       AVAILABLE      LESS HOUR 1
2H         SPRING
 M4
 H           ****************** ****.**     ****.**       ******.**
 I A1$$$$$$$
 I V2$$$$$$$
 I T2$$$$$$$
 I P2$$$$$$$
 M4
 E4 1,DLH3 & 2,TFA1
 E4 1,DLH4 & 2,TFA2
 E4 1,DLH5 & 2,TFM1
 E4 1,DLH6 & 2,TFM2
 E4 1,DLH7 & 2,TFM3
 E4 1,DLH8 & 2,TFMJ
 H         FALL
 E4 1,DLH12& 2,TFSO
 E4 1,DLH13& 2,TFO2
 E4 1,DLH14& 2,TFO3
 E4 1,DLH15& 2,TFON
 E4 1,DLH16& 2,TFN2
 E4 1,DLH17& 2,TFN3
 E4 1,DLH18& 2,TFND
 E4 1,DLH19& 2,TFD2
3H        SELF PROPELLED HARVESTING EQUIPMENT HOURS AVAILABLE AND
 H        USED FOR "IN THE FIELD" HARVESTING OPERATIONS
2H        TIME                     HARVESTING  EQUIPMENT       INCOME CHANGE
 H        PERIODS                  EQUIPMENT   HOURS           FROM ONE
 H                                 HOURS USED  AVAILABLE       LESS HOUR 1
2H         FALL
 E4 1,DLH12 & 2,HFSO
 E4 1,DLH13 & 2,HFO2
 E4 1,DLH14 & 2,HFO3
 E4 1,DLH15 & 2,HFON
```

```
 E4 1,DLH16 & 2,HFN2
 E4 1,DLH17 & 2,HFN3
 E4 1,DLH18 & 2,HFND
2H 1    INCOME CHANGE IS THE CHANGE IN INCOME FROM ONE LESS HOUR BEING
 H      AVAILABLE FOR USE IN THE FARM PLAN.
TH        MAN HOURS AVAILABLE AND USED FOR "IN THE FIELD" OPERATIONS
2H         TIME                 OPERATOR     OPERATOR HRS.  HOURS     INCOME
 H         PERIODS              HRS. WORKED  AVAILABLE      HIRED     CHANGE2
2H         SPRING
 M5
 T-V2$$$$$$$ - T2$$$$$$$ , PASS1
 H          **************** ****.**      *****.**      ****.**   ****.**
 I A1$$$$$$$
 I V2$$$$$$$
 I T2$$$$$$$
 I X3$$$$$$$
 I P2$$$$$$$ + P4$$$$$$$
 T ,PASS2
 L PASS1
 H          **************** ****.**      *****.**      ****.**      0.00
 I A1$$$$$$$
 I V2$$$$$$$
 I T2$$$$$$$
 I X3$$$$$$$
 L PASS2
 M5
 E5 1,DLH3 & 2,FA1 & 3,LH3 & 4,LA1
 E5 1,DLH4 & 2,FA2 & 3,LH4 & 4,LA2
 E5 1,DLH5 & 2,FM1 & 3,LH5 & 4,LM1
 E5 1,DLH6 & 2,FM2 & 3,LH6 & 4,LM2
 E5 1,DLH7 & 2,FM3 & 3,LH7 & 4,LM3
 E5 1,DLH8 & 2,FMJ & 3,LH8 & 4,LMJ
 H         FALL
 E5 1,DLH12 & 2,FSO & 3,LH12 & 4,LSO
 E5 1,DLH13 & 2,FO2 & 3,LH13 & 4,LO2
 E5 1,DLH14 & 2,FO3 & 3,LH14 & 4,LO3
 E5 1,DLH15 & 2,FON & 3,LH15 & 4,LON
```

```
E5 1,DLH16 & 2,FN2 & 3,LH16 & 4,LN2
E5 1,DLH17 & 2,FN3 & 3,LH17 & 4,LN3
E5 1,DLH18 & 2,FND & 3,LH18 & 4,LND
E5 1,DLH19 & 2,FD2 & 3,LH19 & 4,LD2
4H        LABOR
2H         TIME                  OPERATOR     OPERATOR HRS.  HOURS    INCOME
 H         PERIODS               HRS. WORKED  AVAILABLE      HIRED    CHANGE2
 H         SPRING
 M6
 T-P4$$$$$$$ + E,1.0 , PASS3
 H          ***************** ****.**    *****.**     ****.**       0.00
 I A1$$$$$$$
 I V2$$$$$$$
 I T2$$$$$$$
 I X3$$$$$$$
 T ,PASS4
 L PASS3
 H          ***************** ****.**    *****.**     ****.**   ****.**
 I A1$$$$$$$
 I V2$$$$$$$
 I T2$$$$$$$
 I X3$$$$$$$
 I P4$$$$$$$
 L PASS4
 M6
 E6 1,DLH3 & 2,LA1R & 3,LH3 & 4,LA1
 E6 1,DLH4 & 2,LA2R & 3,LH4 & 4,LA2
 E6 1,DLH5 & 2,LM1R & 3,LH5 & 4,LM1
 E6 1,DLH6 & 2,LM2R & 3,LH6 & 4,LM2
 E6 1,DLH7 & 2,LM3R & 3,LH7 & 4,LM3
 E6 1,DLH8 & 2,LMJR & 3,LH8 & 4,LMJ
 E6 1,DLH9 & 2,LJ2R & 3,LH9 & 4,LJ2
 H         SUMMER
 E6 1,DLH10 &2,LJASR & 3,LH10 & 4,LJAS
 H         FALL
 E61,DLH12 & 2,LSOR & 3,LH12 & 4,LSO
 E61,DLH13 & 2,LO2R & 3,LH13 & 4,LO2
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 E61,DLH14 & 2,L03R & 3,LH14 & 4,L03
 E61,DLH15 & 2,LONR & 3,LH15 & 4,LON
 E61,DLH16 & 2,LN2R & 3,LH16 & 4,LN2
 E61,DLH17 & 2,LN3R & 3,LH17 & 4,LN3
 E61,DLH18 & 2,LNDR & 3,LH18 & 4,LND
 E61,DLH19 & 2,LD2R & 3,LH19 & 4,LD2
2H 2 INCOME CHANGE IS THE CHANGE IN INCOME FROM ONE LESS HOUR BEING
 H   AVAILABLE FOR USE IN THE FARM PLAN.
ENDATA
```

APPENDIX D: M.P.S. CONTROL PROGRAM FOR OPTIMIZATION OF A NEW FARM PLAN VIA REVISION OF THE STANDARDIZED PLAN

```
//JOBNAME   JOB   'ACCT#,TIME=3,SIZE=128K',PROGRAMMER
//STEP1   EXEC   MPS360,REGION.MPSEXEC=128K
//MPSCOMP.SYSIN DD *
          PROGRAM
          INITIALZ
          MOVE(XDATA,'PROB1')
          MOVE(XPBNAME,'PBFILE')
          MVADR(XDOUNB,OUT)
          MVADR(XDONFS,NOF)
          MVADR(XMAJERR,OUT)
          XINVERT=1
          ASSIGN('ECON2','ECON2','COMM')
          MVELEXEC ('SAMPROB1','OBJ1')
          PREPIN('ECON2')
          MOVE(XOLDNAME,'PBFILE')
          REVISE('FILE','ECON2')
          SETUP('MAX')
          CLOSEF('REPFILE')
          SETREP
          MOVE(XOBJ,'C')
          MOVE(XRHS,'B')
          RESTORE('NAME','RFILE',1)
          CRASH
          PRIMAL
          SAVE
          REPORT
          IF(XR1C1.NE.1.0,OUT)
          MOVE(XRHS,'B2')
          RESTORE
          PRIMAL
          REPORT
          EXIT
NOF       TRACE
OUT       EXIT
          PEND
/*
//MPSEXEC.STEPLIB   DD   DSNAME=SYS1.MPSMVT,DISP=SHR
```

```
//         DD  DSNAME=PROG.U9123MVL,DISP=(SHR,PASS)
//         DD  DSNAME=PROG.U9123RGP,DISP=(SHR,PASS)
//MPSEXEC.OLDPFILE  DD  UNIT=TAPE,DSNAME=SEQ.U3104RWW,LABEL=(,NL),      X
//     DISP=(OLD,KEEP),VOLUME=SER=TP0347
//MPSEXEC.REPFILE   DD  UNIT=TAPE,DSNAME=SEQ.U3104RWW,LABEL=(1,NL),     X
//     DISP=(OLD,KEEP),VOLUME=SER=TP0535
//MPSEXEC.OBJ1  DD UNIT=TAPE,DSNAME=SEQ.U3104RWW,LABEL=(2,NL),          X
//     DISP=(OLD,KEEP),VOLUME=SER=TP0535
//MPSEXEC.REPWORK  DD  UNIT=SYSDA,SPACE=(CYL,(3),,CONTIG)
//MPSEXEC.ECON2  DD  UNIT=SYSDA,SPACE=(CYL,(3),,CONTIG),DISP=(NEW,PASS)
//MPSEXEC.SYSIN DD *


       DATA ARRAY USED FOR INDEXING (SEE APPENDIX B)


       PRODUCER'S DATA SET (FORMAT IS DEFINED IN APPENDIX F)


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APPENDIX E: INPUT FORMS FOR THE PRODUCER ORIENTED MODEL

CROP PRODUCTION WORKSHEETS

Name	Address

Farm Description

CROP PRODUCTION WORKSHEETS

SECTION 1: General Information.

Operator's present land base excluding pasture and waste lands.[1]	______ acres
Overhead charge on presently operated land (taxes and interest on investment or cash rent)	$______ /acres
Do you wish to rent more land (if resources permit and if profitable)?	YES NO
If you answered the prior question "Yes", enter the cash rent cost per acre on land to be rented (cash rent equivalent basis).	$______ /acre
Do you wish to hire hourly labor if profitable?	YES NO
If you answered the prior question "Yes", enter the hourly hired labor costs.	$______ /hour

Fixed labor costs (average annual cost chargeable to corn, soybeans, oats, meadow and set-aside acres).

Operator & family labor	$______	
Permanent hired labor	$______	
TOTAL		$______

Total annual fixed machinery costs chargeable to corn, soybeans, oats, meadow and set-aside acres.	$______

[1]The operator's land base equals the number of acres either owned or presently rented, which may be put into corn, soybeans, oats, meadow or set-aside acres.

SECTION 2: Management Practices for Erosion Control.

This section is presented to enter necessary information which is consistent with management practices in control of erosion. Continuous soybean production may also be restrained to prevent increased occurrences of disease which adversely affect estimated yields.

What is the maximum acreage of soybeans you think you can grow on your present land base without excess erosion or disease? ______acres

What is the maximum acres of rowcrops permitted, consistent with good land use in prevention of excess soil erosion? (Enter a number larger than your land base if rowcrop acreage need not be restricted.) ______acres

What is the maximum number of acres of fall plowing which would be consistent with acceptable conservation practices on your presently operated rowcrop land base? (Enter a number which is larger than your operated cropable land base if fall plowing need not be restricted.) ______acres

What is the minimum acreage of meadow required for the control of erosion on operated land? ______acres

The characteristics of certain soils are associated with a reduction in corn yield potential when spring plowed. Northern and Central Iowa soil characteristics result in approximately a 5% reduction. In other areas of Iowa, where fall plowing increase the erosion, there may be no reduction in potential yield. Enter your estimated percentage potential yield reduction here. ______%

If you answered "Yes" to the question "Do you wish to rent more land?", then complete the following four questions which pertain to the expected rented land.

What is the maximum percent which may be placed in soybean production without excess erosion or disease? ______%

What is the maximum percent which may be placed in rowcrop production without excess erosion? ______%

What percent may be fall plowed consistent with acceptable conservation practices? ______%

What percent should be put in meadow for good land use? ______%

SECTION 3: Price Expectations.

EXPECTED PRICES PER BUSHEL	SUGGESTED	YOUR ESTIMATES
corn	$1.10/bu.	$_____/bu.
soybeans	$2.50/bu.	$_____/bu.
oats	$ .75/bu.	$_____/bu.
straw	$19./ton	$_____/ton
hay	$20./ton	$_____/ton

SECTION 4: Yield Expectations.

Expected yields for corn and soybeans should be estimated with average yearly weather conditions but with planting and harvesting performed during time periods considered to obtain maximum yields. Yield reductions are imposed in the programming model for late performance of the planting and harvesting operations. Oats, straw and hay production are not given timeliness considerations; thus, the estimated yields will be the harvested yields.

	SUGGESTED YIELD	YIELD FOR YOUR SOIL AND MANAGEMENT PRACTICES
corn	130 bu./acre	_____bu./acre
soybeans	40 bu./acre	_____bu./acre
oats	80 bu./acre	_____bu./acre
straw	3/4 ton/acre	_____ton/acre
hay	4 ton/acre	_____ton/acre

SECTION 5: Variable Costs for Production of Corn.

	Suggested fuel, oil, repair, & misc. variable costs per acre	Cost for your soil, equipment & management practices
Preplant Field Preparation		
chop stalks	$ .42	$____/acre
spread P and K	.21	$____/acre
disk	.26	$____/acre
plow	1.29	$____/acre
apply N (7 knife anhydrous applicator)	.43	$____/acre
disk (once early)	.35	$____/acre
Subtotal	$2.96	$____/acre
Planting Time Field Operations		
disk (once)	$ .35	$____/acre
plant	.45	$____/acre
harrow	.17	$____/acre
wagon (tractor & wagon or pickup usage to haul seed, herbicides and other supplies)	.25	$____/acre
cultivation & other weed control-		
rotary hoe (1½ times)	.30	$____/acre
cultivation (1½ times)	.63	$____/acre
Subtotal	$2.15	$____/acre
Harvest Period		
harvester (self-propelled harvester or tractor & pull-type equipment)	$2.04	$____/acre
haul (.8¢/bu.)	$1.00	$____/acre
Subtotal	$3.04	$____/acre

SECTION 5: Variable Costs for Production of Corn. (Continued)

	Other costs	Your other costs
Other Variable Costs		
fertilizer & lime	\$18.00/acre	\$ /acre
herbicide & insecticide	\$ 6.00/acre	\$ /acre
seed	\$ 5.00/acre	\$ /acre
interest charge on variable costs[1]	\$ .04/dollar invested in variable costs	\$ /dollar invested
Custom Hire Costs (by period)		
Preplant field preparation	\$ 0.00/acre	\$ /acre
Planting time field operations	\$ 0.00/acre	\$ /acre
Harvest period	\$ 0.00/acre	\$ /acre

[1] Interest charge should be calculated:
interest rate/annum multiplied by average length of investment in months divided by 12.

Example: 8% interest on money invested for ½ year or \$.08 x 6 mo./12 mo. = \$.04/dollar invested in variable costs.

SECTION 6: Variable Costs for Production of Soybeans.

	Suggested fuel, oil, repair, & misc. variable costs per acre	Cost for your soil, equipment & management practices
Preplant Field Preparation		
spread P and K	$ .21	$____/acre
plow	1.19	$____/acre
disk (once)	.35	$____/acre
Subtotal	$1.75	$____/acre
Planting Period Field Operations		
disk	$ .35	$____/acre
plant	.45	$____/acre
wagon (tractor & wagon or pickup to haul seed, herbicide & other supplies)	.50	$____/acre
harrow	.17	$____/acre
cultivation & weed control-		
rotary hoe (twice over)	.40	$____/acre
cultivation (1½ times over)	.63	$____/acre
Subtotal	$2.50	$____/acre
Harvest		
harvest	$ .96	$____/acre
haul (.8¢/bu.)	.32	$____/acre
Subtotal	$1.28	$____/acre
Other Variable Costs	Other costs	Your other costs
fertilizer	$5.40/acre	$____/acre
herbicide	$4.00/acre	$____/acre
seed	$4.00/acre	$____/acre
interest charge on variable costs[1]	$ .04/dollar invested in variable costs	$____/dollar invested
Custom Hire Costs (by period)		
preplant field preparation	$0.00/acre	$____/acre
planting time field operations	$0.00/acre	$____/acre
harvest period	$0.00/acre	$____/acre

---

[1]Interest charge should be calculated:
interest rate/annum multiplied by average length of investment in months divided by 12. See section 5 for example.

SECTION 7: Labor Requirements for Production of Corn.

	Suggested requirements per acre Hours	Requirements for your soil, equipment & management practices Hours
<u>Preplant Field Preparation</u>		
chop stalks	.20	
spread P and K	.27	______
disk	.16	______
plow	.56	______
apply N	.20	______
disk	.20	______
Subtotal	1.59	
<u>Plant-time Field Operations</u>		
disk	.20	
plant	.33	______
harrow	.16	______
Subtotal	.69	
<u>Cultivation & Other Weed Control</u>		
rotary hoe ($1\frac{1}{2}$ times)	.17	
cultivation ($1\frac{1}{2}$ times)	.33	
<u>Harvest</u>		
combine	.75	
haul	.63	______
Subtotal of Harvest Period	1.38	

SECTION 8: Man Hours of Field Time Required for Production of Corn.

	Suggested requirements per acre Hours	Requirements for your soil, equipment & management practices Hours
Preplant Field Preparation		
chop stalks	.17	____
spread P and K	.23	____
disk	.14	____
plow	.49	____
apply N	.18	____
disk	.18	____
Subtotal	1.39	
Plant-time Field Operations		
disk	.18	____
plant	.26	____
harrow	.13	____
Subtotal	.57	
Cultivation & Other Weed Control		
rotary hoe (1½ times)	.16	
cultivation (1½ times)	.30	
Harvest		
combine	.68	____
haul	.60	____
Subtotal of Harvest Period	1.28	

SECTION 9: Tractor Hours of Field Time Required for Production of Corn.

	Suggested requirements per acre Hours	Requirements for your soil, equipment & management practices Hours
Preplant Field Preparation		
chop stalks	.17	
spread P and k	.23	
disk	.14	
plow	.49	
apply N	.18	
disk	.18	
Subtotal	1.39	
Plant-time Field Operations		
disk	.18	
plant	.26	
harrow	.13	
Subtotal	.57	
Cultivation & Other Weed Control		
rotary hoe (1½ times)	.16	
cultivation (1½ times)	.30	
Harvest		
combine	.68	
haul[1]	.68	

[1]Tractor time requirements are the same as the self-propelled combine requirements because each can only be performed as fast as the slowest operation is performed.

Hauling tractor requirements should be doubled if a pull-typed harvester unit is used.

SECTION 10: Labor Requirements for Production of Soybeans.

	Suggested requirements per acre Hours	Requirements for your soil, equipment & management practices Hours
Preplant Field Preparations		
spread P and K	.27	______
plow	.52	______
disk	.16	______
Subtotal	.95	
Planting Period Operations		
disk	.20	______
plant	.33	______
harrow	.16	______
Subtotal	.69	
Cultivation & Other Weed Control		
rotary hoe (twice over)	.22	
cultivation ($1\frac{1}{2}$ times over)	.33	
Harvest		
combine	.56	______
haul	.43	______
Subtotal of Harvest Period	.99	

SECTION 11: Man Hours of Field Time Required for Production of Soybeans.

	Suggested requirements per acre Hours	Requirements for your soil, equipment & management practices Hours
Preplant Field Preparations		
spread P and K	.23	
plow	.46	
disk	.14	
Subtotal	.83	
Planting Period Operations		
disk	.18	
plant	.25	
harrow	.13	
Subtotal	.56	
Cultivation & Other Weed Control		
rotary hoe (twice over)	.22	
cultivation (1½ times over)	.30	
Harvest		
combine	.53	
haul	.53	
Subtotal of Harvest Period	1.06	

SECTION 12: Tractor Hours of Field Time Required for Production of Soybeans.

	Suggested requirements per acre Hours	Requirements for your soil, equipment & management practices Hours
Preplant Field Preparations		
spread P and K	.23	______
plow	.46	______
disk	.14	______
Subtotal	.83	
Planting Period Operations		
disk	.18	______
plant	.25	______
harrow	.13	______
Subtotal	.56	
Cultivation & Other Weed Control		
rotary hoe (twice over)	.22	
cultivation (1½ times over)	.30	
Harvest		
combine	.53	
haul[1]	.53	

[1]Tractor requirements are the same as the self-propelled combine time requirements because hauling can only be performed as fast as the combining operation is performed.

Hauling tractor requirements should be doubled if a pull-type harvester unit is used.

SECTION 13: Variable Costs for Production of Oats.

	Suggested fuel, oil, repair & misc. variable costs per acre	Cost for your soil, equipment & management practices
Growing		
disk (twice)	$ .70	$____/acre
seed	.15	$____/acre
harrow	.17	$____/acre
spread fertilizer	.22	$____/acre
wagon (tractor & wagon or pickup to haul seed)	.25	$____/acre
Harvesting		
combine	.96	$____/acre
haul & store grain (.7¢/bu.)	.56	$____/acre
rake straw	.35	$____/acre
bale straw	.00	$____/acre
haul & store straw	.30	$____/acre
Total of Growing & Harvesting	$3.66	$____/acre

Other Variable Costs	Other costs	Your other costs
fertilizer	$4.50/acre	$____/acre
seed	$2.50/acre	$____/acre
machine hire	$2.05/acre	$____/acre
hired labor for straw baling[1] (.85 x $2./hr.)	$1.70/acre	$____/acre
interest charge on variable costs[2]	$ .04/dollar invested in variable costs	$____/dollar invested

---

[1] .85 hours have been charged as variable costs because straw baling is considered to be at least a two man job.

[2] Interest charge should be calculated:

> Interest rate/annum multiplied by the average length of investment in months divided by 12. See section 5 for example.

SECTION 14: Time Requirements for Production of Oats.

	Suggested requirements per acre Hours	Requirements for your soil, equipment & management practices Hours
Labor Requirements		
Growing		
disk (twice)	.32	____
seed	.18	____
harrow	.16	____
spread fertilizer	.24	____
Subtotal	.90	
Harvest		
combine	.40	____
haul & store grain	.25	____
rake straw	.26	____
bale straw	.25	____
haul & store straw	.25	____
Subtotal	1.41	
Man Hours of Field Time Required		
disk	.28	____
seed	.15	____
harrow	.13	____
spread fertilizer	.21	____
Subtotal	.77	
Tractor Hours of Field Time Required		
disk	.28	____
seed	.15	____
harrow	.13	____
spread fertilizer	.21	____
Subtotal	.77	

SECTION 15: Variable Costs for Production of Hay.

How many years should meadow be in production to attain maximum returns on investment in establishment costs (seed, fuel, oil, repairs and labor) but still meet crop rotation needs? _____ years

	Times over per year	Repairs & misc. variable costs	Times over per year	Costs for your soil, equipment & management practices
Growing				
packer seeder	½	$ .16/acre	___	$____/acre
fertilizer	½	.12/acre	___	$____/acre
clip stubble	½	.19/acre	___	$____/acre
Harvest				
mow	3	1.20/acre	___	$____/acre
condition	3	1.10/acre	___	$____/acre
rake	3	1.10/acre	___	$____/acre
bale		0.00/acre		$____/acre
haul & store		1.25/acre		$____/acre
Total of Growing & Harvest		$5.12/acre		$____/acre

Other Variable Costs	Other costs	Your other costs
fertlizer	$4.25/acre	$____/acre
seed	$3.80/acre	$____/acre
machine hire	$10.44/acre	$____/acre
hire labor for hay baling[1]	$5.68/acre	$____/acre
interest charge on variable costs[2]	$ .06/dollar invested in variable costs	$____/dollar invested

---

[1] 2.84 hours have been charged as variable costs because hay baling is considered to be at least a two man job.

[2] Interest charge should be calculated:

> Interest rate/annum multiplied by the average length of investment in months divided by 12. See section 5 for an example.

SECTION 16: Time Requirements for Production of Hay.

	Times over per year	Suggested requirements per acre per year Hours	Times over per year	Requirements for your soil, equipment & management practices Hours
<u>Labor Requirements</u>				
<u>Growing</u>				
packer seeder	½	.18		
spread fertilizer	½	.12		
Subtotal		.30		
clip stubble	½	.19		
<u>Harvest</u>				
mow	3	1.19		
condition	3	1.08		
rake	3	1.05		
bale		1.07		
haul & store		1.06		
Subtotal of Harvest		5.45		
<u>Man Hours of Field Time Required</u>				
<u>Growing</u>				
packer seeder	½	.16		
spread fertilizer	½	.11		
Subtotal		.27		
<u>Harvest</u>				
mow	3	.99		
condition	3	.90		
rake	3	.87		
bale		.79		
haul & store		.78		
Subtotal		4.33		

SECTION 16: Time Requirements for Production of Hay. (Continued)

	Times over per year	Suggested requirements per acre per year Hours	Times over per year	Requirements for your soil, equipment & management practices Hours
<u>Tractor Hours of Field Time Required</u>				
<u>Growing</u>				
packer seeder	½	.16	____	____
spread fertilizer	½	.11	____	____
Subtotal		.27		☐
<u>Harvesting</u>				
mow	3	.99	____	____
condition	3	.90	____	____
rake	3	.87	____	____
bale		.79		____
haul & store		.79		____
Subtotal		4.33		☐

SECTION 17: General Set-Aside Program Information.

Those who wish to evaluate participation in the Set-Aside Program should answer questions 1 and 3 "Yes". The "Yes" answers result in two solutions being reported. A plan with participation and a plan with no participation will be reported for purposes of comparison. Do not answer question 1 "Yes" if you already are sure that program participation is either unprofitable or otherwise undesirable. However, if you are sure program participation is more profitable than no participation then answer question 1 "Yes" and question 3 "No". Answering question 1 "No" eliminates the need to complete the rest of the input forms for the Set-Aside Program.

1. Do you wish to participate in the Set-Aside Program? YES NO

   If you answered the prior question "Yes", then complete parts 2 and 3 below, and section 18.

2. Corn base acreage on operated land. ______ acres
   Price support payment/acre on operated land[1] $______/acres
   Conservation base acreage on operated land. ______ acres

3. Do you wish to have the no participation solution reported? YES NO

---

[1]The price support payment may be calculated as follows:

2.5 x price support payment x A.S.C.S. projected farm yield = $______/acre.

Example: 2.5 x $.32/bu. x 100 bu./acre = $80./acre.

SECTION 18: Set-Aside Acres Cost and Time Requirements.

	Estimated Costs	Costs for your soil, machinery, & management practices
Operations		
disk	$ .52	$
seed	.15	$
harrow	.17	$
wagon use	.20	$
clip	.38	$
Subtotal	$1.42	$
Seed (oats) cost	$1.40	$

	Suggested requirements per acre per year Hours	Time requirements for your equipment & management practices Hours
Labor Requirements		
disk (twice)	.32	
seed	.18	
harrow	.16	
Subtotal	.66	
clip	.36	
Man Hours of Field Time Required		
disk (twice)	.28	
seed	.15	
harrow	.13	
Subtotal	.56	
Tractor Hours of Field Time Required		
disk (twice)	.28	
seed	.15	
harrow	.13	
Subtotal	.56	

SECTION 19: Available Labor Supply for Crop Production Excluding Down Time for Major Repairs. (Only the data in column J is required for input.)

Do you wish to use a 6 or 7 day work week for planning purposes?........................6   7

		Suggested hours available per day for crop production				Your hours available per day for crop production			
Periods	Calendar days per period	Full time operator	Family (15 yr. old son)	Full time hired laborer	Total hours C+D+E	Full time operator	Family	Full time hired laborers	Total hours G+H+I
A	B	C	D	E	F	G	H	I	J
Apr. 1-20	20	8	1	9	18				
Apr. 21-30	10	9	2	9	20				
May 1-10	10	9	2	9	20				
May 11-20	10	9	2	9	20				
May 21-30	10	9	2	9	20				
May 31-June 9	10	9	6	9	24				
June 10-19	10	9	6	9	24				
June 20-Sept. 24	97	8	6	9	23				
Sept. 25-Oct. 5	11	9	2	9	20				
Oct. 6-15	10	9	2	9	20				
Oct. 16-25	10	9	2	9	20				
Oct. 26-Nov. 4	10	9	1	9	19				
Nov. 5-14	10	9	1	9	19				
Nov. 15-24	10	9	1	9	19				
Nov. 25-Dec. 4	10	9	1	9	19				
Dec. 5-15	11	9	1	9	19				

SECTION 20: Available Man Hours of Field Time Excluding all Down Time Except for Small "on-the-spot" Repairs.
(Only the data in column J is required for input.)

		Suggested hours available per suitable field day for crop production				Your hours available per suitable field day for crop production			
Periods	Suitable field day per period[1]	Full time operator	Family (15 yr. old son)	Full time hired laborer	Total hours C+D+E	Full time operator	Family	Full time hired laborers	Total hours G+H+I
A	B	C	D	E	F	G	H	I	J
Apr. 1-20	11.32	8.5	1.50	8.5	18.50				
Apr. 21-30	6.84	9.0	2.50	8.5	20.00				
May 1-10	6.21	9.5	2.50	8.5	20.50				
May 11-20	6.80	9.5	2.50	8.5	20.50				
May 21-30	7.01	9.5	2.50	8.5	20.50				
May 31-June 9	6.42	9.5	7.00	8.5	25.00				
Sept. 25-Oct. 5	8.32	9.5	2.25	8.5	20.25				
Oct. 6-15	7.64	9.5	2.25	8.5	20.25				
Oct. 16-25	7.79	9.5	2.00	8.5	20.00				
Oct. 26-Nov. 4	8.05	9.5	1.00	8.5	19.00				
Nov. 5-14	7.40	9.5	1.00	8.5	19.00				
Nov. 15-24	6.85	9.5	1.00	8.5	19.00				
Nov. 25-Dec. 4	4.31	9.5	1.00	8.5	19.00				
Dec. 5-15	1.70	9.0	1.00	8.5	18.50				

[1]Data from Midwest Farm Planning Manual edited by Sydney C. James.

SECTION 21: Available Tractor Hours of Field Time Excluding All Down Time Except for Small "on-the-spot" Repairs.

Periods	Suitable field day per period	Suggested hours available per suitable field day[1]	Your hours available per suitable field day[2]
Apr. 1-20	11.32	19.0	
Apr. 21-30	6.84	20.0	
May 1-10	6.21	21.0	
May 11-20	6.80	21.0	
May 21-30	7.01	21.0	
May 31-June 9	6.42	21.0	
Sept. 25-Oct. 5	8.32	21.0	
Oct. 6-15	7.64	21.0	
Oct. 16-25	7.79	21.0	
Oct. 26-Nov. 4	8.05	21.0	
Nov. 5-14	7.40	21.0	
Nov. 15-24	6.85	21.0	
Nov. 25-Dec. 4	4.31	21.0	
Dec. 5-15	1.70	20.0	

[1]Assumes 2 tractors available for use in the field.

[2]Adjust the number of hours per day for the number of tractors.

SECTION 22: Available Harvest Equipment Hours of Field Time Excluding All Down Time Except for Small "on-the-spot" Repairs.

Periods	Suitable field day per period	Suggested hours available per suitable field day[1]	Your hours available per suitable field day[2]
Sept. 25-Oct. 5	8.32	10.0	
Oct. 6-15	7.64	10.0	
Oct. 16-25	7.79	10.0	
Oct. 26-Nov. 4	8.05	10.0	
Nov. 5-14	7.40	10.0	
Nov. 15-24	6.85	10.0	
Nov. 25-Dec. 4	4.31	10.0	

[1]Assumes 1 combine available for use in the field.

[2]Adjust the number of hours per day for the number of combines.

APPENDIX F: DATA INPUT FORMAT

Appendix Table 1. Data input format

Section	Card	Card format[a]	Information punched[b]
Title page	1	(W72)	Punch name and address.
	2	(W72)	Punch farm discription.
1	3	7(W10)	Punch alphabetic and numeric entries in the
	4	1(W10)	right-hand column.
2	5	7(W10)	Punch right-hand column.
	6	2(W10)	
3	7	5(W10)	Punch right-hand column.
4	8	5(W10)	Punch right-hand column.
5	9	7(W10)	Punch only blocked entries in right-hand
	10	3(W10)	column for sections 5 through 16.
6	11	7(W10)	
	12	3(W10)	
7	13	5(W10)	
8	14	5(W10)	
9	15	6(W10)	
10	16	5(W10)	
11	17	5(W10)	
12	18	6(W10)	
13	19	6(W10)	
14	20	4(W10)	
15	21	7(W10)	
16	22	7(W10)	

[a]The format a(Wn) indicates the width of field and the number of coefficients and alphabetic entries per card where a represents the number of datum entries per card and n the field width within a datum may be punched. Numeric data should have decimal points punched. Alphabetic and numeric entries do not need to right or left justify.

[b]The communication form of filing (see Marvel input program) requires all zero entries to be represented by numbers which approximate zero i.e., represented by 0.000001 or smaller. Nonzero entries are required to insure the numbers will be filed on ECON2 for revision of the elements in the pre-optimized program on CLDPFILE.

Appendix Table 1. (Continued)

Section	Card	Card format[a]	Information punched[b]
17	23	5(W10)	Punch alphabetic and numeric information in right-hand column.
18	24	6(W10)	Punch only the blocked entries.
19	25	7(W10)	Punch the 6 or 7 above the table and the right-hand column of boxed entries (column J).
	26	7(W10)	
	27	3(W10)	
20	28	7(W10)	Punch column J.
	29	7(W10)	
21	30	7(W10)	Punch the right-hand column.
	31	7(W10)	
22	32	7(W10)	Punch the right-hand column.

APPENDIX G: FOUR, SIX, EIGHT AND TWELVE ROW MACHINERY SETS

FOUR ROW CONVENTIONAL TILLAGE MACHINERY SET[a]
(4-40" Tillage--2-40" Harvest Equipment)

Machine	No. of units	List price/ unit	Suggested annual ownership costs	Your no. of units	Your annual ownership costs
50 drawbar horsepower tractor	2	$6725.00	$1901.00		$
12' tandem disk	1	$ 950.00	$ 171.73		$
3-16" plow	1	$1609.20	$ 274.56		$
4-40" planter	1	$1625.40	$ 286.43		$
20' spiketooth harrow	1	$ 268.75	$ 45.02		$
4-40" rotary hoe	1	$ 626.40	$ 109.64		$
2-40" corn head	1	$2322.00	$ 516.09		$
12' platform	1	$1055.00	$ 246.80		$
self-propelled combine (140 bu./hr.)	1	$8856.00	$1823.43		$
34' elevator	1	$ 687.50	$ 129.44		$
wagon (150 bu.)	3	$ 500.00	$ 281.49		$
packer seeder	1	$1600.00	$ 391.76		$
mower	1	$ 587.50	$ 101.03		$
stalk chopper (6')	1	$ 901.80	$ 157.46		$
dryer (150 bu./hr. continuous flow)	1	$5108.00	$ 855.60		$
endgate seeder	1	$ 140.00	$ 23.45		$
other					$
Total annual costs to be inserted in the final entry of section 1.			$7468.31		$

[a]Source: Data for all the machinery sets was adapted from Purdue University data (2) and Greer (5).

SIX ROW CONVENTIONAL TILLAGE MACHINERY SET
(6-30" Tillage--3-30" Harvest Equipment)

Machine	No. of units	List price/ unit	Suggested annual ownership costs	Your no. of units	Your annual ownership costs
70 drawbar horsepower tractor	2	\$9720.00	\$2743.60	____	\$____
14' tandem disk	1	\$1187.50	\$ 213.61	____	\$____
4-16" plow	1	\$1792.80	\$ 307.11	____	\$____
6-30" planter	1	\$2457.00	\$ 427.30	____	\$____
7 knife NH_3 applicator	1	\$1404.00	\$ 223.08	____	\$____
30 spiketooth harrow	1	\$ 320.00	\$ 53.60	____	\$____
6-30" rotary hoe	1	\$ 918.00	\$ 160.82	____	\$____
6-30" cultivator	1	\$1287.50	\$ 220.80	____	\$____
3-30" corn head	1	\$3726.00	\$ 826.54	____	\$____
16' platform	1	\$1281.25	\$ 303.93	____	\$____
self-propelled combine (185 bu./hr.)	1	\$9612.00	\$1980.05	____	\$____
40' elevator	1	\$ 837.50	\$ 157.08	____	\$____
wagon (185 bu.)	3	\$ 648.00	\$ 355.86	____	\$____
packer seeder	1	\$1600.00	\$ 391.76	____	\$____
mower	1	\$ 587.50	\$ 101.03	____	\$____
fertilizer spreader (4 ton bulk)	1	\$1620.00	\$ 277.35	____	\$____
stalk chopper (12')	1	\$1782.00	\$ 311.09	____	\$____
dryer (200 bu./hr. continuous flow)	1	\$6696.00	\$1121.58	____	\$____
endgate seeder	1	\$ 140.00	\$ 23.45	____	\$____
other				____	\$____
				____	\$____
				____	\$____
Total annual costs to be inserted in the final entry of section 1.			\$10,199.64		\$____

EIGHT ROW CONVENTIONAL TILLAGE MACHINERY SET
(8-30" Tillage--4-30" Harvest Equipment)

Machine	No. of units	List price/ unit	Suggested annual ownership costs	Your no. of units	Your annual ownership costs
80 drawbar horsepower tractor	2	$11,710.00	$3301.80		$
18' tandem disk	1	$ 2,125.00	$ 376.94		$
5-16" plow	1	$ 2,025.00	$ 348.64		$
8-30" planter	1	$ 3,456.00	$ 599.88		$
9 knife NH_3	1	$ 1,620.00	$ 278.35		$
30' spiketooth harrow	1	$ 320.00	$ 53.60		$
8-30" rotary hoe	1	$ 1,101.60	$ 193.92		$
8-30" cultivator	1	$ 1,458.00	$ 249.75		$
4-30" corn head	1	$ 4,968.00	$1101.36		$
16' platform	1	$ 1,281.25	$ 303.93		$
self-propelled combine (230 bu./hr.)	1	$11,934.00	$2456.00		$
40' elevator	1	$ 837.50	$ 157.08		$
wagon (185 bu.)	4	$ 648.00	$ 474.48		$
packer seeder	1	$ 1,600.00	$ 391.76		$
mower	1	$ 587.50	$ 101.03		$
fertilizer spreader	1	$ 1,620.00	$ 277.35		$
stalk chopper (12')	1	$ 1,782.00	$ 311.09		$
dryer (250 bu./hr. continuous flow)	1	$ 8,640.00	$1447.20		$
endgate seeder	1	$ 140.00	$ 23.45		$
other					$
Total annual costs to be inserted in the final entry of section 1.			$12,447.61		$

TWELVE ROW CONVENTIONAL TILLAGE MACHINERY SET
(12-30" Tillage--6-30" Harvest Equipment)

Machine	No. of units	List price/ unit	Suggested annual ownership costs	Your no. of units	Your annual ownership costs
90 drawbar horsepower tractor	2	$13,700.00	$3860.00		$
20' tandem disk	1	$ 2,410.00	$ 428.28		$
6-16" plow	1	$ 2,295.00	$ 396.81		$
12-30" planter	1	$ 5,427.00	$ 940.02		$
9 knife NH_3 applicator	1	$ 1,620.00	$ 278.35		$
30' spiketooth harrow	1	$ 320.00	$ 53.60		$
12-30" rotary hoe	1	$ 2,106.00	$ 366.86		$
12-30" cultivator	1	$ 1,944.00	$ 335.90		$
6-30" corn head	1	$ 6,642.00	$1474.88		$
18' platform	1	$ 1,481.25	$ 350.43		$
self-propelled combine (325 bu./hr.)	1	$15,984.00	$3284.00		$
40' elevator	1	$ 837.50	$ 157.08		$
wagon (300 bu.)	3	$ 1,080.00	$ 534.90		$
packer seeder	1	$ 1,600.00	$ 391.76		$
mower	1	$ 587.50	$ 101.03		$
fertilizer spreader	1	$ 1,620.00	$ 277.35		$
stalk chopper (12')	1	$ 1,782.00	$ 311.09		$
dryer (300 bu./hr. continuous flow)	1	$10,530.00	$1763.78		$
endgate seeder	1	$ 140.00	$ 23.45		$
other					$
Total annual costs to be inserted in the final entry of section 1.			$15,329.57		$

APPENDIX H: STANDARDIZED OPERATING COSTS AND TIME REQUIREMENTS

OPERATING COST AND TIME REQUIREMENTS[a]

Equipment set or operation	Size of equipment unit	Suggested fuel, oil, repair & misc. variable costs $/acre	Labor requirements hours/acre	Field time & tractor time requirements hours/acre
Chop stalks	6'	$ .340	.330	.300
	12'	$ .420	.200	.170
Spread P&K	4 ton bulk spreader	$ .214	.270	.230
Disk stalks	10'	$ .279	.224	.192
	14'	$ .260	.160	.142
	20'	$ .233	.118	.105
Early or late disk (plowed ground)	10'	$ .375	.280	.252
	14'	$ .350	.200	.180
	20'	$ .314	.147	.133
Plow (corn stalks)	3 bottom	$1.370	.649	.569
	4 bottom	$1.290	.560	.490
	5 bottom	$1.240	.473	.415
	6 bottom	$1.200	.430	.376
(soybeans)	3 bottom	$1.270	.607	.532
	4 bottom	$1.190	.520	.460
	5 bottom	$1.150	.442	.388
	6 bottom	$1.110	.402	.276
NH_3	5 knife	$ .440	.271	.251
	7 knife	$ .430	.200	.180
	9 knife	$ .420	.160	.140

OPERATING CCST AND TIME REQUIREMENTS

Equipment set or operation	Size of equipment unit	Suggested fuel, oil, repair & misc. variable costs $/acre	Labor requirements hours/acre	Field time & tractor time requirements hours/acre
Planting (corn)	4-38"	$ .430	.327	.253
	6-30"	$ .450	.335	.259
	8-30"	$ .440	.300	.232
	12-30"	$ .430	.230	.179
(soybeans)	4-38"	$ .430	.325	.244
	6-30"	$ .450	.333	.250
	8-30"	$ .440	.298	.223
	12-30"	$ .430	.228	.177
Harrow	20'	$ .190	.240	.205
	30'	$ .170	.160	.130
Rotary hoe	4-38"	$ .210	.133	.130
	6-30"	$ .200	.113	.110
	8-30"	$ .190	.088	.086
	12-30"	$ .170	.062	.061
Cultivation	4-38"	$ .420	.210	.190
	6-30"	$ .420	.220	.200
	8-30"	$ .420	.190	.170
	12-30"	$ .420	.154	.140
Harvest (corn)	2-38" header	$ .016/bu.	.794	.720
	4-38" header	$ .014/bu.	.469	.425
	3-30" header	$ .017/bu.	.750	.680
	4-30" header	$ .016/bu.	.621	.563

OPERATING COST AND TIME REQUIREMENTS

Equipment set or operation	Size of equipment unit	Suggested fuel, oil, repair & misc. variable costs $/acre	Labor requirements hours/acre	Field time & tractor time requirements hours/acre
Harvest				
(soybeans)	14' platform	$1.000/acre	.560	.530
	16' platform	$ .980/acre	.517	.489
	18' platform	$ .960/acre	.473	.448
	24' platform	$ .920/acre	.359	.340
(oats)	14' platform	$1.000/acre	.440	--
	16' platform	$ .980/acre	.400	--
	18' platform	$ .960/acre	.370	--
(hay) (145 bales or 4 ton)	PTO baler	$3.260/acre	1.070	.790
(straw) (40 bales or 3/4 ton)	PTO baler	$ .680/acre	.250	--
Mow (3 cutting)	7' bar	$1.200/acre	1.190	.990
Condition	--	$1.100/acre	1.080	.900
Mow-condition	7' bar	$1.840/acre	1.320	1.110
Rake	--	$1.100/acre	1.050	.870

[a]Source: Adapted from data from Howell (8) and Hull (10).

APPENDIX I: EXAMPLE REPORT GENERATOR OUTPUTS FOR THE OPTIMAL FARM PLAN WITH SET-ASIDE PARTICIPATION AND THE OPTIMAL FARM PLAN WITHOUT PARTICIPATION

REPORT

TIME = 2.08

THIS SECTION REPORTS THE OPTIMUM SOLUTION WITH 20.00% PARTICIPATION IN THE SET-ASIDE PROGRAM

INCOME STATEMENT

INCOME			
SOYBEAN SALES	$ 9782.52		
CORN SALES	76709.29		
SET-ASIDE PAYMENTS	8064.00		
OAT SALES	9556.11		
STRAW VALUE OR SALES	2540.57		
HAY VALUE OR SALES	.		
TOTAL GROSS INCOME			106652.49
EXPENSES			
SOYBEANS			
FUEL, OIL, REPAIRS AND			
MISC. VARIABLE COSTS	650.35		
FERTILIZER	635.07		
HERBICIDE	470.42		
SEED	470.42		
MACHINE HIRE	.		
INTEREST ON VARIABLE COSTS	89.05		
SUBTOTAL		2315.31	
CORN			
FUEL, OIL, REPAIRS AND			
MISC. VARIABLE COSTS	4684.45		
FERTILIZER	10346.02		
HERBICIDE AND INSECTICIDE	3448.67		
SEED	2873.89		
DRYING	4225.56		
MACHINE HIRE	.		
INTEREST ON VARIABLE COSTS	854.12		
SUBTOTAL		26432.71	
SET-ASIDE ACRES			
FUEL, OIL, REPAIRS AND			
MISC. VARIABLE COSTS	119.28		
COVER CROP SEED COSTS	117.60		
MACHINE HIRE	.		
SUBTOTAL		236.88	
OATS			
FUEL, OIL, REPAIRS AND			
MISC. VARIABLE COSTS	652.53		
FERTILIZER	802.29		
SEED	445.71		
MACHINE HIRE	365.49		
HOURLY HIRED LABOR COSTS	303.09		
INTEREST ON VARIABLE COSTS	102.76		
SUBTOTAL		2671.86	

HAY

FUEL, OIL, REPAIRS AND				
MISC. VARIABLE COSTS		.		
FERTILIZER		.		
SEED		.		
MACHINE HIRE		.		
HOURLY HIRED LABOR COSTS		.		
INTEREST ON VARIABLE COSTS		.		
SUBTOTAL			.	
OTHER HIRED LABOR COSTS			970.84	
TOTAL VARIABLE COSTS				32627.59
RETURNS OVER VARIABLE COSTS				74024.90
TOTAL FIXED MACHINERY COSTS				10199.64
TOTAL FIXED LABOR COSTS				12000.00
TOTAL FIXED LAND COSTS				24000.00
LAND RENTAL	354.67 ACRES			14186.76
RETURNS TO MANAGEMENT					13638.49

LAND USE SUMMARY

SOYBEANS

TOTAL ACRES PLANTED	117.60
TOTAL BUSHELS HARVESTED	4309.48
AVERAGE YIELD	36.64

CORN

TOTAL ACRES PLANTED	574.78
TOTAL BUSHELS HARVESTED	71027.12
AVERAGE YIELD	123.57

OATS AND STRAW

TOTAL ACRES SEEDED	178.29
TOTAL BUSHELS HARVESTED	14262.86
AVERAGE YIELD	80.00
TOTAL TONS STRAW HARVESTED	133.71
AVERAGE YIELD (TONS)	.75

HAY

TOTAL ACRES IN MEADOW	.
TOTAL TONS HARVESTED	.
AVERAGE YIELD	.

SET-ASIDE ACRES

TOTAL ACRES IN SET-ASIDE PROGRAM	84.00

SCHEDULE OF FIELD OPERATIONS

SET-ASIDE ACRES
ACRES PREPARED AND SEEDED FROM APRIL 1-20 84.00

ACRES OF MEADOW PRODUCTION DURING APRIL 1-20 .
HAY HARVEST OCURS DURING THE PERIODS-
FIRST CUTTING, MAY 31 - JUNE 19
SECOND AND THIRD CUTTINGS, JUNE 20 - SEPT. 24.

ACRES OF OATS SEEDED FROM APRIL 1-20 178.29
OATS HARVEST AND STRAW BALEING OCURS DURING THE PERIOD JUNE 20 - SEPT. 24.

SOYBEANS
PREPLANTING PERIOD FIELD PREPARATION (SPREAD P&K, DISK AND PLOW)

ACRES PREPARED BY PERIODS

FALL PERIODS	ACRES
JUNE 20 - SEPT. 24	.
SEPT. 25 - OCT. 5	.
OCT. 6-15	57.80
OCT. 16-25	.
OCT. 26 - NOV. 4	.
NOV. 5-14	.
NOV. 15-24	.
NOV. 25 - DEC. 4	.
DEC. 5-15	.
SPRING PERIODS	**ACRES**
APR. 1-20	.
APR. 21-30	.
MAY 1-10	.
MAY 11-20	.
MAY 21-30	39.36
MAY 31 -JUNE 9	20.44
JUNE 10-19	.

PLANTING SCHEDULE (FINAL FIELD PREPARATION AND PLANTING)

PERIODS	ACRES
MAY 1-10	.
MAY 11-20	.
MAY 21-30	97.16
MAY 31 -JUNE 9	20.44
JUNE 10-19	.

HARVESTING SCHEDULE

HARVEST DATES /	PLANTING DATES				
	MAY 1-10	MAY 11-20	MAY 21-30	MAY 31 - JUNE 9	JUNE 10-19
OCT. 6-15	.	.	--------	--------	--------
OCT. 16-25	.	.	97.16	20.44	--------
OCT. 16-25	.	.	.	.	.
OCT. 26 - NOV. 4	.	.	.	.	.

CORN

PREPLANTING PERIOD FIELD PREPARATION (CHOP STALKS, SPREAD P&K,
DISK, PLOW, AND APPLY NITROGEN)

ACRES PREPARED BY PERIODS

FALL PERIODS	ACRES
JUNE 20 - SEPT. 24	262.29
SEPT. 25 - OCT. 5	53.86
OCT. 6-15	14.95
OCT. 16-25	50.44
OCT. 26 - NOV. 4	52.12
NOV. 5-14	47.91
NOV. 15-24	44.35
NOV. 25 - DEC. 4	27.91
DEC. 5-15	20.96
SPRING PERIODS	ACRES
APR. 1-20	.
APR. 21-30	.
MAY 1-10	.
MAY 11-20	.
MAY 21-30	.
MAY 31 -JUNE 9	.

PLANTING SCHEDULE (FINAL FIELD PREPARATION AND PLANTING)

PERIODS	ACRES
APR. 21-30	206.05
MAY 1-10	196.43
MAY 11-20	172.30
MAY 21-30	.
MAY 31 -JUNE 9	.

HARVESTING SCHEDULE

HARVEST DATES /	PLANTING DATES				
	APRIL 21-30	MAY 1-10	MAY 11-20	MAY 21-30	MAY 31 - JUNE 9
SEPT. 25 - OCT. 5	110.10	.	.	.	.
OCT. 6-15	95.94	5.16	.	.	.
OCT. 16-25	.	11.43	.	.	.
OCT. 26 - NOV. 4	.	106.53	.	.	.
NOV. 5-14	.	73.32	24.61	.	.
NOV. 15-24	.	.	90.65	.	.
NOV. 25 - DEC. 4	.	.	57.04	.	.

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RESOURCES USED, UNUSED AND THEIR VALUE

RETURNS TO THE LAST ACRE OF LAND AVAILABLE IN THE FARM PLAN 40.00

TRACTOR HOURS AVAILABLE AND USED FOR "IN THE FIELD" OPERATIONS

TIME PERIODS	TRACTOR HOURS USED	TRACTOR HOURS AVAILABLE	INCOME CHANGE FROM ONE LESS HOUR 1
SPRING			
APR. 1-20	184.32	184.32	-22.14
APR. 21-30	117.24	117.24	-37.13
MAY 1-10	111.77	111.77	-31.47
MAY 11-20	122.38	122.38	-21.51
MAY 21-30	126.17	126.17	-4.23
MAY 31 -JUNE 9	114.10	115.54	.
FALL			
SEPT. 25 - OCT. 5	149.74	149.74	-4.23
OCT. 6-15	137.50	137.50	-4.23
OCT. 16-25	140.21	140.21	-4.23
OCT. 26 - NOV. 4	144.88	144.88	-4.23
NOV. 5-14	133.18	133.18	-4.23
NOV. 15-24	123.29	123.29	-4.23
NOV. 25 - DEC. 4	77.58	77.58	-4.23
DEC. 5-15	29.14	29.14	-4.23

SELF PROPELLED HARVESTING EQUIPMENT HOURS AVAILABLE AND USED FOR "IN THE FIELD" HARVESTING OPERATIONS

TIME PERIODS	HARVESTING EQUIPMENT HOURS USED	EQUIPMENT HOURS AVAILABLE	INCOME CHANGE FROM ONE LESS HOUR 1
FALL			
SEPT. 25 - OCT. 5	74.87	74.87	-9.23
OCT. 6-15	68.75	68.75	-16.30
OCT. 16-25	70.10	70.10	-20.78
OCT. 26 - NOV. 4	72.44	72.44	-22.30
NOV. 5-14	66.59	66.59	-22.28
NOV. 15-24	61.64	61.64	-22.05
NOV. 25 - DEC. 4	38.79	38.79	-21.62

1 INCOME CHANGE IS THE CHANGE IN INCOME FROM ONE LESS HOUR BEING AVAILABLE FOR USE IN THE FARM PLAN.

MAN HOURS AVAILABLE AND USED FOR "IN THE FIELD" OPERATIONS

TIME PERIODS	OPERATOR HRS. WORKED	OPERATOR HRS. AVAILABLE	HOURS HIRED	INCOME CHANGE2
SPRING				
APR. 1-20	179.47	179.47	4.85	-2.00
APR. 21-30	117.24	117.24	.	-2.00
MAY 1-10	109.10	109.10	2.67	-2.00
MAY 11-20	119.47	119.47	2.91	-2.00
MAY 21-30	123.16	123.16	3.01	-2.00
MAY 31 -JUNE 9	114.10	137.55	.	0.00
FALL				
SEPT. 25 - OCT. 5	144.39	144.39	71.41	-2.00
OCT. 6-15	132.59	132.59	65.57	-2.00
OCT. 16-25	133.52	133.52	75.88	-2.00
OCT. 26 - NOV. 4	131.08	131.08	77.72	-2.00
NOV. 5-14	120.49	120.49	71.45	-2.00
NOV. 15-24	111.54	111.54	66.14	-2.00
NOV. 25 - DEC. 4	70.18	70.18	41.63	-2.00
DEC. 5-15	26.95	26.95	2.19	-2.00

LABOR

TIME PERIODS	OPERATOR HRS. WORKED	OPERATOR HRS. AVAILABLE	HOURS HIRED	INCOME CHANGE2
SPRING				
APR. 1-20	211.05	308.88	4.85	0.00
APR. 21-30	143.20	171.60	.	0.00
MAY 1-10	133.85	171.60	2.67	0.00
MAY 11-20	142.70	171.60	2.91	0.00
MAY 21-30	142.96	171.60	3.01	0.00
MAY 31 -JUNE 9	121.63	205.92	.	0.00
JUNE 10-19	122.06	205.92	.	0.00
SUMMER				
JUNE 20 - SEPT. 24	774.15	1912.68	.	0.00
FALL				
SEPT. 25 - OCT. 5	166.17	188.40	71.41	0.00
OCT. 6-15	152.63	171.60	65.57	0.00
OCT. 16-25	136.52	171.60	75.88	0.00
OCT. 26 - NOV. 4	152.16	163.02	77.72	0.00
NOV. 5-14	139.86	163.02	71.45	0.00
NOV. 15-24	129.48	163.02	66.14	0.00
NOV. 25 - DEC. 4	81.47	163.02	41.63	0.00
DEC. 5-15	31.14	178.98	2.19	0.00

2 INCOME CHANGE IS THE CHANGE IN INCOME FROM ONE LESS HOUR BEING AVAILABLE FOR USE IN THE FARM PLAN.

REPORT

TIME = 2.74

THIS SECTION REPORTS THE OPTIMUM SOLUTION WITH NO SET-ASIDE PROGRAM PARTICIPATION

INCOME STATEMENT

INCOME			
SOYBEAN SALES	$ 8481.35		
CORN SALES	76661.12		
SET-ASIDE PAYMENTS	.		
OAT SALES	12830.59		
STRAW VALUE OR SALES	3411.12		
HAY VALUE OR SALES	.		
TOTAL GROSS INCOME			101384.17
EXPENSES			
SOYBEANS			
FUEL, OIL, REPAIRS AND MISC. VARIABLE COSTS	566.02		
FERTILIZER	552.72		
HERBICIDE	409.42		
SEED	409.42		
MACHINE HIRE	.		
INTEREST ON VARIABLE COSTS	77.50		
SUBTOTAL		2015.08	
CORN			
FUEL, OIL, REPAIRS AND MISC. VARIABLE COSTS	4684.45		
FERTILIZER	10346.02		
HERBICIDE AND INSECTICIDE	3448.67		
SEED	2873.89		
DRYING	4089.78		
MACHINE HIRE	.		
INTEREST ON VARIABLE COSTS	854.12		
SUBTOTAL		26296.92	
SET-ASIDE ACRES			
FUEL, OIL, REPAIRS AND MISC. VARIABLE COSTS	.		
COVER CROP SEED COSTS	.		
MACHINE HIRE	.		
SUBTOTAL		.	
OATS			
FUEL, OIL, REPAIRS AND MISC. VARIABLE COSTS	876.12		
FERTILIZER	1077.19		
SEED	598.44		
MACHINE HIRE	490.72		
HOURLY HIRED LABOR COSTS	406.94		
INTEREST ON VARIABLE COSTS	137.98		
SUBTOTAL		3587.39	

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HAY

FUEL, OIL, REPAIRS AND				
MISC. VARIABLE COSTS	.			
FERTILIZER	.			
SEED	.			
MACHINE HIRE	.			
HOURLY HIRED LABOR COSTS	.			
INTEREST ON VARIABLE COSTS	.			
SUBTOTAL		.		
OTHER HIRED LABOR COSTS		954.67		
TOTAL VARIABLE COSTS			32854.07	
RETURNS OVER VARIABLE COSTS			68530.10	
TOTAL FIXED MACHINERY COSTS			10199.64	
TOTAL FIXED LABOR COSTS			12000.00	
TOTAL FIXED LAND COSTS			24000.00	
LAND RENTAL 316.51 ACRES			12660.40	
RETURNS TO MANAGEMENT				9670.06

LAND USE SUMMARY

SOYBEANS

TOTAL ACRES PLANTED	102.35
TOTAL BUSHELS HARVESTED	3736.28
AVERAGE YIELD	36.50

CORN

TOTAL ACRES PLANTED	574.78
TOTAL BUSHELS HARVESTED	70982.51
AVERAGE YIELD	123.50

OATS AND STRAW

TOTAL ACRES SEEDED	239.38
TOTAL BUSHELS HARVESTED	19150.13
AVERAGE YIELD	80.00
TOTAL TONS STRAW HARVESTED	179.53
AVERAGE YIELD (TONS)	.75

HAY

TOTAL ACRES IN MEADOW	.
TOTAL TONS HARVESTED	.
AVERAGE YIELD	.

SET-ASIDE ACRES

TOTAL ACRES IN SET-ASIDE PROGRAM	.

SCHEDULE OF FIELD OPERATIONS

SET-ASIDE ACRES
ACRES PREPARED AND SEEDED FROM APRIL 1-20 .

ACRES OF MEADOW PRODUCTION DURING APRIL 1-20 .
HAY HARVEST OCURS DURING THE PERIODS-
FIRST CUTTING, MAY 31 - JUNE 19
SECOND AND THIRD CUTTINGS, JUNE 20 - SEPT. 24.

ACRES OF OATS SEEDED FROM APRIL 1-20 239.38
OATS HARVEST AND STRAW BALEING OCURS DURING THE PERIOD JUNE 20 - SEPT. 24.

SOYBEANS
PREPLANTING PERIOD FIELD PREPARATION (SPREAD P&K, DISK AND PLOW)

ACRES PREPARED BY PERIODS

FALL PERIODS	ACRES
JUNE 20 - SEPT. 24	.
SEPT. 25 - OCT. 5	.
OCT. 6-15	29.17
OCT. 16-25	.
OCT. 26 - NOV. 4	.
NOV. 5-14	.
NOV. 15-24	.
NOV. 25 - DEC. 4	.
DEC. 5-15	.
SPRING PERIODS	ACRES
APR. 1-20	.
APR. 21-30	.
MAY 1-10	.
MAY 11-20	.
MAY 21-30	50.89
MAY 31 -JUNE 9	22.29
JUNE 10-19	.

PLANTING SCHEDULE (FINAL FIELD PREPARATION AND PLANTING)

PERIODS	ACRES
MAY 1-10	.
MAY 11-20	.
MAY 21-30	80.07
MAY 31 -JUNE 9	22.29
JUNE 10-19	.

HARVESTING SCHEDULE

HARVEST DATES / PLANTING DATES	MAY 1-10	MAY 11-20	MAY 21-30	MAY 31 - JUNE 9	JUNE 10-19
OCT. 6-15	.	.	--------	--------	--------
OCT. 16-25	.	.	80.07	22.29	--------
OCT. 16-25	.	.	.	.	.
OCT. 26 - NOV. 4	.	.	.	.	.

CORN

PREPLANTING PERIOD FIELD PREPARATION (CHOP STALKS, SPREAD P&K, DISK, PLOW, AND APPLY NITROGEN)

ACRES PREPARED BY PERIODS

FALL PERIODS	ACRES
JUNE 20 - SEPT. 24	239.38
SEPT. 25 - OCT. 5	59.68
OCT. 6-15	32.04
OCT. 16-25	50.44
OCT. 26 - NOV. 4	52.12
NOV. 5-14	47.91
NOV. 15-24	44.35
NOV. 25 - DEC. 4	27.91
DEC. 5-15	20.96
SPRING PERIODS	**ACRES**
APR. 1-20	.
APR. 21-30	.
MAY 1-10	.
MAY 11-20	.
MAY 21-30	.
MAY 31 -JUNE 9	.

PLANTING SCHEDULE (FINAL FIELD PREPARATION AND PLANTING)

PERIODS	ACRES
APR. 21-30	206.05
MAY 1-10	196.43
MAY 11-20	172.30
MAY 21-30	.
MAY 31 -JUNE 9	.

HARVESTING SCHEDULE

HARVEST DATES /	PLANTING DATES				
	APRIL 21-30	MAY 1-10	MAY 11-20	MAY 21-30	MAY 31 - JUNE 9
SEPT. 25 - OCT. 5	98.22	.	.	.	.
OCT. 6-15	101.10	.	.	.	.
OCT. 16-25	6.73	16.59	.	.	.
OCT. 26 - NOV. 4	.	106.53	.	.	.
NOV. 5-14	.	73.32	24.61	.	.
NOV. 15-24	.	.	90.65	.	.
NOV. 25 - DEC. 4	.	.	57.04	.	.

RESOURCES USED, UNUSED AND THEIR VALUE

RETURNS TO THE LAST ACRE OF LAND AVAILABLE IN THE FARM PLAN 40.00

TRACTOR HOURS AVAILABLE AND USED FOR "IN THE FIELD" OPERATIONS

TIME PERIODS	TRACTOR HOURS USED	TRACTOR HOURS AVAILABLE	INCOME CHANGE FROM ONE LESS HOUR 1
SPRING			
APR. 1-20	184.32	184.32	-27.18
APR. 21-30	117.24	117.24	-36.51
MAY 1-10	111.77	111.77	-32.72
MAY 11-20	122.38	122.38	-23.06
MAY 21-30	126.17	126.17	-7.02
MAY 31 -JUNE 9	115.54	115.54	-2.93
FALL			
SEPT. 25 - OCT. 5	149.74	149.74	-7.02
OCT. 6-15	137.50	137.50	-7.02
OCT. 16-25	140.21	140.21	-7.02
OCT. 26 - NOV. 4	144.88	144.88	-7.02
NOV. 5-14	133.18	133.18	-7.02
NOV. 15-24	123.29	123.29	-7.02
NOV. 25 - DEC. 4	77.58	77.58	-7.02
DEC. 5-15	29.14	29.14	-7.02

SELF PROPELLED HARVESTING EQUIPMENT HOURS AVAILABLE AND USED FOR "IN THE FIELD" HARVESTING OPERATIONS

TIME PERIODS	HARVESTING EQUIPMENT HOURS USED	EQUIPMENT HOURS AVAILABLE	INCOME CHANGE FROM ONE LESS HOUR 1
FALL			
SEPT. 25 - OCT. 5	66.79	74.87	.
OCT. 6-15	68.75	68.75	-7.07
OCT. 16-25	70.10	70.10	-10.30
OCT. 26 - NOV. 4	72.44	72.44	-11.82
NOV. 5-14	66.59	66.59	-11.79
NOV. 15-24	61.64	61.64	-11.57
NOV. 25 - DEC. 4	38.79	38.79	-11.13

1 INCOME CHANGE IS THE CHANGE IN INCOME FROM ONE LESS HOUR BEING AVAILABLE FOR USE IN THE FARM PLAN.

MAN HOURS AVAILABLE AND USED FOR "IN THE FIELD" OPERATIONS

TIME PERIODS	OPERATOR HRS. WORKED	OPERATOR HRS. AVAILABLE	HOURS HIRED	INCOME CHANGE2
SPRING				
APR. 1-20	179.47	179.47	4.85	-2.00
APR. 21-30	117.24	117.24	.	-2.00
MAY 1-10	109.10	109.10	2.67	-2.00
MAY 11-20	119.47	119.47	2.91	-2.00
MAY 21-30	123.16	123.16	3.01	-2.00
MAY 31 -JUNE 9	115.54	137.55	.	0.00
FALL				
SEPT. 25 - OCT. 5	144.39	144.39	64.28	-2.00
OCT. 6-15	132.59	132.59	65.57	-2.00
OCT. 16-25	133.52	133.52	74.93	-2.00
OCT. 26 - NOV. 4	131.08	131.08	77.72	-2.00
NOV. 5-14	120.49	120.49	71.45	-2.00
NOV. 15-24	111.54	111.54	66.14	-2.00
NOV. 25 - DEC. 4	70.18	70.18	41.63	-2.00
DEC. 5-15	26.95	26.95	2.19	-2.00

LABOR

TIME PERIODS	OPERATOR HRS. WORKED	OPERATOR HRS. AVAILABLE	HOURS HIRED	INCOME CHANGE2
SPRING				
APR. 1-20	210.59	308.88	4.85	0.00
APR. 21-30	143.20	171.60	.	0.00
MAY 1-10	133.85	171.60	2.67	0.00
MAY 11-20	142.70	171.60	2.91	0.00
MAY 21-30	142.12	171.60	3.01	0.00
MAY 31 -JUNE 9	123.41	205.92	.	0.00
JUNE 10-19	117.87	205.92	.	0.00
SUMMER				
JUNE 20 - SEPT. 24	790.68	1912.68	.	0.00
FALL				
SEPT. 25 - OCT. 5	166.15	188.40	64.28	0.00
OCT. 6-15	152.61	171.60	65.57	0.00
OCT. 16-25	138.77	171.60	74.93	0.00
OCT. 26 - NOV. 4	152.16	163.02	77.72	0.00
NOV. 5-14	139.86	163.02	71.45	0.00
NOV. 15-24	129.48	163.02	66.14	0.00
NOV. 25 - DEC. 4	81.47	163.02	41.63	0.00
DEC. 5-15	31.14	178.98	2.19	0.00

2 INCOME CHANGE IS THE CHANGE IN INCOME FROM ONE LESS HOUR BEING AVAILABLE FOR USE IN THE FARM PLAN.